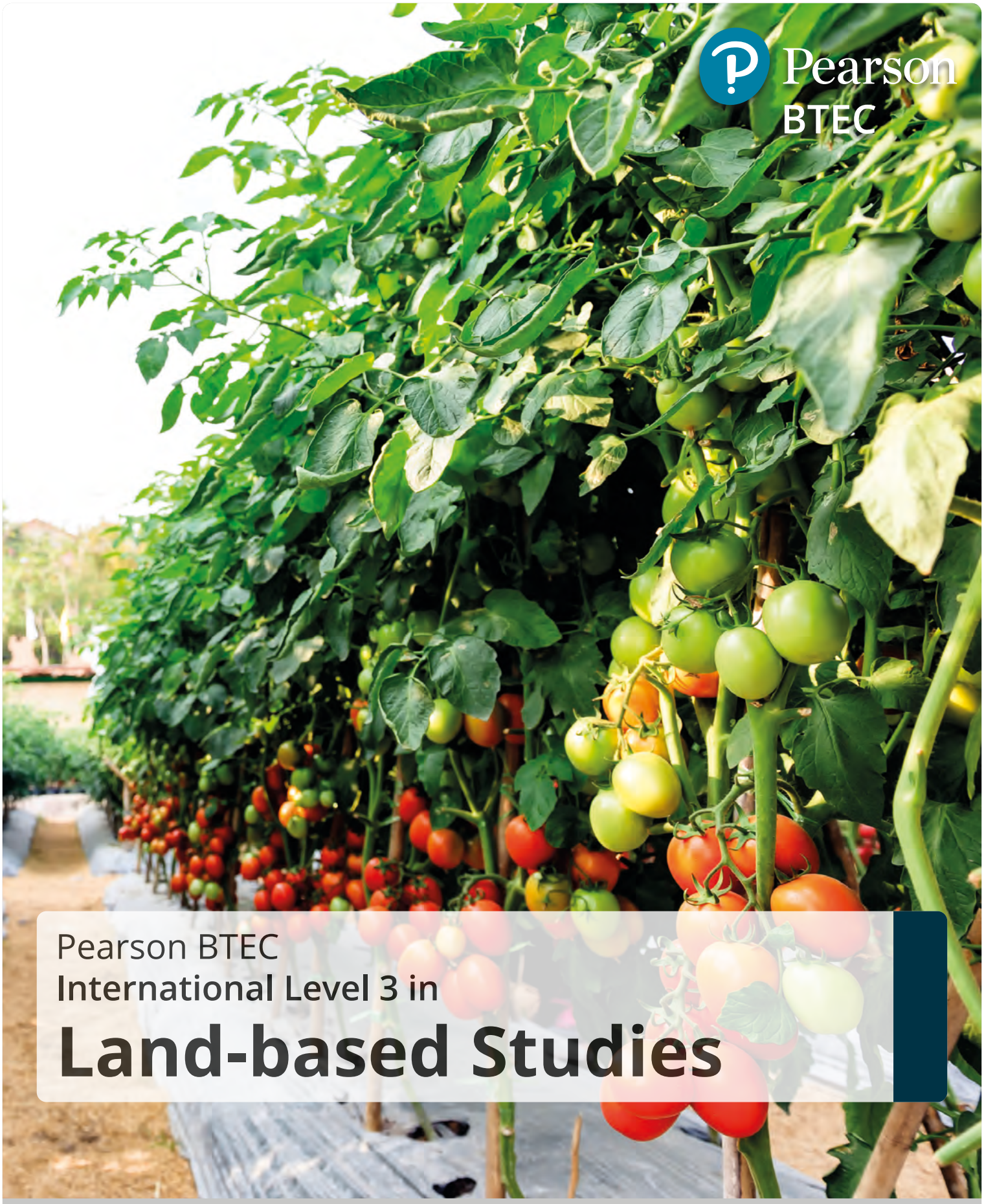

Pearson BTEC

Pearson BTEC
International Level 3 in

Land-based Studies

L3

Specification

First teaching from April 2020

Issue 6

Pearson BTEC International Level 3 Qualifications in Agriculture/Horticulture/ Land-based Studies

Specification

First teaching April 2020

Issue 6

About Pearson

We are the world's leading learning company operating in countries all around the world. We provide content, assessment and digital services to learners, educational institutions, employers, governments and other partners globally. We are committed to helping equip learners with the skills they need to enhance their employability prospects and to succeed in the changing world of work. We believe that wherever learning flourishes so do people.

This specification is Issue 6. We will inform centres of any changes to this issue. The latest issue can be found on our website.

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Welcome

With a track record built over 40 years of learner success, our BTEC International Level 3 qualifications are recognised internationally by governments, industry and higher education. BTEC International Level 3 qualifications allow learners to progress to the workplace – either directly or via study at a higher level. Over 100,000 BTEC learners apply to university every year. Their Level 3 BTECs, either on their own or in combination with A Levels, are accepted by UK and international universities, and higher-education institutes for entry to relevant degree programmes.

Career-ready education

BTECs enable a learner-centred approach to education, with a flexible, unit-based structure and knowledge applied to project-based assessments. BTECs focus on the holistic development of the practical, interpersonal and thinking skills required to be successful in employment and higher education.

When creating the BTEC International Level 3 qualifications in this suite, we worked with many employers, higher-education providers, colleges and schools to ensure that we met their needs. Employers are looking for recruits who have a thorough grounding in the latest industry requirements and work-ready skills, for example teamwork. Learners who progress to higher education need experience of research, extended writing and meeting deadlines. BTEC qualifications provide the breadth and depth of learning to give learners this experience.

BTEC qualifications address these needs by offering:

- a range of BTEC qualification sizes, each with a clear purpose, so that there is something to suit each learner's choice of study programme and progression plans
- internationally relevant content, which is closely aligned with employer and higher-education needs
- assessments and projects chosen to help learners progress; this means that some assessments and projects are set by you to meet local needs, while others are set by Pearson, ensuring a core of skills and understanding common to all learners.

We provide a full range of support, both resources and people, to ensure that learners and teachers have the best possible experience during their course. See *Section 10 Resources and support*, for details of the support we offer.

Collaborative development

Learners who complete their BTEC International Level 3 qualification in Agriculture/ Horticulture/Land-based Studies aim to go on to employment, often via the stepping stone of higher education. It was, therefore, essential that we developed these qualifications in close collaboration with experts from professional bodies, businesses and universities, and with the providers who will be delivering the qualifications.
We engaged experts in the development of these qualifications to ensure that the content meets providers' needs and gives learners quality preparation to help them progress. We are grateful to all the university and further-education lecturers, teachers, employers, professional body representatives and other individuals who have generously shared their time and expertise to help us develop these new qualifications.

Summary of Pearson BTEC International Level 3 Qualifications in Agriculture/Land-based Studies specification Issue 6 changes

Summary of changes made between the previous issue and this current issue	Page number
The following specialist pathways have been withdrawn and subsequently removed from this issue: Pearson BTEC International Level 3 Diploma (720) Horticulture Pearson BTEC International Level 3 Extended Diploma (1080) Horticulture	Throughout

If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com/en/support/contact-us.html.

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Introduction to the BTEC International Level 3 qualifications for the land-based sector

This specification contains all the information you need to deliver the Pearson BTEC International Level 3 Qualifications in Agriculture/Horticulture/Land-based Studies. We also refer you to other handbooks and policies. This specification includes all the units for these qualifications.

These qualifications are part of the suite of land-based qualifications offered by Pearson. In this suite, there are qualifications that focus on different progression routes, allowing learners to choose the one best suited to their aspirations. These qualifications are not regulated in England.

All qualifications in the suite share some common units and assessments, which gives learners some flexibility in moving between sizes.

In the land-based sector these qualifications are:

Pearson BTEC International Level 3 Certificate in Land-based Studies (180 GLH)

Pearson BTEC International Level 3 Subsidiary Diploma in Land-based Studies (360 GLH)

Pearson BTEC International Level 3 Foundation Diploma in Agriculture (540 GLH)

Pearson BTEC International Level 3 Foundation Diploma in Horticulture (540 GLH)

Pearson BTEC International Level 3 Diploma in Agriculture (720 GLH)

Pearson BTEC International Level 3 Extended Diploma in Agriculture (1080 GLH)

This specification signposts the other essential documents and support that you need as a centre in order to deliver, assess and administer the qualifications, including the staff development required. A summary of all essential documents is given in *Section 7 Administrative arrangements*. Information on how we can support you with these qualifications is given in *Section 10 Resources and support*.

The information in this specification is correct at the time of publication.

Qualifications, sizes and purposes at a glance

Title	Size and structure	Summary purpose
Pearson BTEC International Level 3 Certificate in Land-based Studies	180 GLH Equivalent in size to 0.5 of an International A Level. Three units, of which one is mandatory and assessed by a Pearson Set Assignment. Mandatory content (33.3%).	This qualification is designed to support learners who want an introduction to the sector through applied learning. The qualification supports progression to higher education as part of a programme of study that includes other appropriate BTEC International Level 3 qualifications or International A Levels.
Pearson BTEC International Level 3 Subsidiary Diploma in Land-based Studies	360 GLH Equivalent in size to one International A Level. Six units of which two are mandatory and assessed by a Pearson Set Assignment. Mandatory content (33.3%).	This qualification is designed to support learners who are interested in learning about the land-based industries alongside other fields of study, with a view to progressing to a wide range of higher-education courses, not necessarily in land-based related subjects. The qualification is designed to be taken as part of a programme of study that includes other appropriate BTEC International Level 3 qualifications or International A Levels.
Pearson BTEC International Level 3 Foundation Diploma in Agriculture/ Pearson BTEC International Level 3 Foundation Diploma in Horticulture	540 GLH Equivalent in size to 1.5 International A Levels. Nine units, of which five are mandatory and four which are assessed by a Pearson Set Assignment. Mandatory content (55.5%).	These qualifications are designed to support learners who want to study land-based studies as one-year, full-time courses, or for those wanting to take it alongside another area of complementary or contrasting study as part of a two-year, full-time study programme. The qualifications support progression to higher education if taken as part of a programme of study that includes other BTEC International Level 3 qualifications or International A Levels.

Title	Size and structure	Summary purpose
Pearson BTEC International Level 3 Diploma in Agriculture	720 GLH Equivalent in size to two International A Levels. At least 11 units, of which six are mandatory and five which are assessed by a Pearson Set Assignment. Mandatory content (50%).	This qualification is designed to support learners who want to study land-based studies as the main element alongside another area of complementary or contrasting study as part of a two-year, full-time study programme. The qualification supports progression to higher education if taken as part of a programme of study that includes other BTEC International Level 3 qualifications or International A Levels.
Pearson BTEC International Level 3 Extended Diploma in Agriculture	1080 GLH Equivalent in size to three International A Levels. At least 17 units, of which six are mandatory and five which are assessed by a Pearson Set Assignment. Mandatory content (33.3%).	This qualification is designed as a full-time course to support learners who want to take land-based studies as the main focus of a two-year, full-time study programme. The qualification supports progression to higher education in its own right.

Structures of the qualifications at a glance

This table shows all the units and the qualifications to which they contribute. The full structure for these Pearson BTEC International Level 3 Qualifications in Agriculture, Horticulture and Land-based Studies is shown in *Section 2 Structure*. **You must refer to the full structure to select units and plan your programme.**

Key

Pearson Set Assignment units are shown in bold | **M** Mandatory units | **O** Optional units

LBS Land-based Studies | **Agric** Agriculture | **Hort** Horticulture

Unit (number and title)	Unit size (GLH)	Certificate (180 GLH)	Subsidiary Diploma (360 GLH)	Foundation Diploma (540 GLH)		Diploma (720 GLH)	Extended Diploma (1080 GLH)
		LBS	LBS	Agric	Hort	Agric	Agric
1 Plant and Soil Science	**60**	**M**	**M**	**M**	**M**	**M**	**M**
2 Estate Skills	**60**	**O**	**O**	**M**	**M**	**M**	**M**
3 Understanding Environmental Management	**60**	**O**	**M/O**	**M**	**M**	**M**	**M**
4 Developing a Land-based Enterprise	**60**	**O**	**O**	**M**	**M**	**M**	**M**
5 Operational and Environmental Activities in Land-based Enterprises	**60**					**M**	**M**
6 Land-based Business Improvements	**60**	**O**	**M/O**	**M**	**M**	**M**	**M**
7 Work Experience in the Land-based Sectors	**60**	**O**	**O**	**O**	**O**	**O**	**O**
8 Animal Production Systems	**60**		**O**	**O**		**O**	**O**
9 International Poultry Production	**60**			**O**		**O**	**O**
10 Farm Livestock Husbandry	**60**	**O**	**O**	**O**		**O**	**O**
11 International Pig Production	**60**			**O**		**O**	**O**
12 International Sheep Production	**60**			**O**		**O**	**O**
13 International Beef Production	**60**			**O**		**O**	**O**
14 International Dairy Production	**60**			**O**		**O**	**O**
15 Livestock Health and Diseases	**60**		**O**	**O**		**O**	**O**

Unit (number and title)	Unit size (GLH)	Certificate (180 GLH)	Subsidiary Diploma (360 GLH)	Foundation Diploma (540 GLH)		Diploma (720 GLH)	Extended Diploma (1080 GLH)
		LBS	LBS	Agric	Hort	Agric	Agric
16 Livestock Nutrition	60		O	O		O	O
17 Crop Production	60	O	O	O		O	O
18 Crop Handling, Storage and Quality Assurance	60		O	O		O	O
19 Combinable Crop Production and Processing	60					O	O
20 Grass and Forage Crop Production	60					O	O
21 Root Crop and Field Vegetable Production	60					O	O
22 Organic Agricultural Production	60					O	O
23 Land-based Machinery Operations	60			O	O	O	O
24 Land-based Workshop Practices	60					O	O
25 Selecting and Managing Land-based Machinery	60					O	O
26 Applied Agricultural Farming Practice	120			O			O
27 Identification, Planting and Care of Plants	60	O	O		O		
28 Routine Plant Management	60		O		O		
29 Plant Propagation Activities	60		O		O		
30 Tree and Shrub Pruning and Maintenance	60		O		O		
31 Nursery Stock Production	60		O		O		
32 Maintenance of Sports and Amenity Turf	60		O		O		
33 Pests and Disease in Plants	60				O		
34 Identification, Planting and Care of Trees	60				O		
35 Participating in Horticultural Tasks at Events	60						
36 Resource and Operations Planning for Event-based Horticultural Activities	60						

Unit (number and title)	Unit size (GLH)	Certificate (180 GLH)	Subsidiary Diploma (360 GLH)	Foundation Diploma (540 GLH)		Diploma (720 GLH)	Extended Diploma (1080 GLH)
		LBS	LBS	Agric	Hort	Agric	Agric
37 Maintaining the Health and Quality of Turf in Parks and Gardens	60						
38 Protected Horticultural Crop Production	60	O	O		O		
39 Outdoor Horticultural Crop Production	60	O	O		O		
40 Zoological Horticulture	60						
41 Wildlife Ecology and Conservation Management	60	O	O				
42 Landscape and Garden Design	60						
43 Constructing Decorative Landscape Features	60						
44 Linear and Level Surveying	60						
45 Computer-aided Design in Horticulture	60						
46 Managing Soil Water	60						
47 Sustainable and Renewable Land-based Practices	60						
48 Specialist Tourism	60					O	O

Qualification and unit content

Pearson has developed the content of the new BTEC International Level 3 qualifications in collaboration with employers and representatives from higher education, and relevant professional bodies. In this way, we have ensured that content is up to date and that it includes the knowledge, understanding, skills and personal attributes required in the sector.

The mandatory content ensures that all learners are following a coherent programme of study and that they acquire knowledge, understanding and skills that will be recognised and valued by higher education and employers. Learners are expected to show achievement across mandatory units as detailed in *Section 2 Structure*.

BTEC qualifications encompass applied learning that brings together knowledge and understanding with practical and technical skills. This applied learning is achieved through learners performing vocational tasks that encourage the development of appropriate vocational behaviours and transferable skills. Transferable skills are those such as communication, teamwork and research and analysis, which are valued in both higher education and the workplace. Opportunities to develop these skills are signposted in the units.

Our approach provides rigour and balance, and promotes the ability to apply learning immediately in new contexts.

Centres should ensure that content, for example content that references regulation, legislation, policies and regulatory/standards organisations, is kept up to date. The units include guidance on approaches to breadth and depth of coverage, which can be modified to ensure that content is current and reflects international variations.

Assessment

Assessment is designed to fit the purpose and objective of the qualification. It includes a range of assessment types and styles suited to vocational qualifications in the sector. All assessment is internal but some mandatory units have extra controls on assessment and are assessed using Pearson Set Assignments. Additionally, some units are synoptic.

Pearson Set Assignment (PSA) units

Some units in the qualifications are assessed using a Pearson Set Assignment. Each assessment is set by Pearson and is marked by teachers.

Set assignment units are subject to external standards verification processes common to all BTEC units. By setting an assignment for some units, we can ensure that all learners take the same assessment for a specific unit. Learners are permitted to resit set assignment units during their programme. Please see Section 6 for further information.

Set assignments are available from June each year and are valid until the end of August in the following year. For detailed information on the Pearson Set Assignment, please see the table in *Section 2 Structure*. For further information on preparing for assessment, see *Section 5 Assessment structure*.

Internal assessment

All units in the sector are internally assessed and subject to external standards verification. Before you assess you will need to become an approved centre, if you are not one already. You will need to prepare to assess using the guidance in *Section 6 Internal assessment*.

For units where there is no Pearson Set Assignment, you select the most appropriate assessment styles according to the learning set out in the unit. This ensures that learners are assessed using a variety of styles to help them develop a broad range of transferable skills. Learners could be given opportunities to:

- write up the findings of their own research
- use case studies to explore complex or unfamiliar situations
- carry out projects for which they have choice over the direction and outcomes
- demonstrate practical and technical skills using appropriate tools/processes etc.

For these units, Pearson will provide an Authorised Assignment Brief that you can use. You will make grading decisions based on the requirements and supporting guidance given in the units. Learners may not make repeated submissions of assignment evidence. For further information, please see *Section 6 Internal assessment*.

Language of assessment

Assessment of the units for these qualifications is available in English but can be translated as necessary.

A learner taking the qualification/s may be assessed in sign language where it is permitted for the purpose of reasonable adjustment for learners of determination. For information on reasonable adjustments for learners of determination, see *Section 7 Administrative arrangements*.

Grading for units and qualifications

Achievement of the qualification requires demonstration of depth of study in each unit, assured acquisition of a range of practical skills required for employment or for progression to higher education, and successful development of transferable skills. Learners who achieve a qualification will have achieved across mandatory units, including synoptic assessment, where applicable.

Units are assessed using a grading scale of Distinction (D), Merit (M), Pass (P) and Unclassified (U). All mandatory and optional units contribute proportionately to the overall qualification grade, for example a unit of 120 GLH will contribute double that of a 60 GLH unit.

Qualifications in the suite are graded using a scale of P to D*, **or** PP to D*D*, **or** PPP to D*D*D*. Please see *Section 9 Understanding the qualification grade*, for more details. The relationship between qualification grading scales and unit grades will be subject to regular review as part of Pearson's standards monitoring processes, on the basis of learner performance and in consultation with key users of the qualifications.

1 Qualification purpose and progression

Pearson BTEC International Level 3 qualifications in Agriculture/Horticulture/Land-based Studies

Who are these qualifications for?

The Pearson BTEC International Level 3 qualifications in Agriculture are designed either for learners in the 16–19 age group, who wish to pursue careers such as crop production and/or livestock production via higher education to access graduate entry employment in an agricultural role, or alternatively through junior agricultural employment.

The Pearson BTEC International Level 3 qualifications in Horticulture are designed either for learners in the 16–19 age group, who wish to pursue careers such as plant production, amenity production or sport surfaces via higher education to access graduate entry employment in a horticultural role, or alternatively through junior horticultural employment.

The Pearson BTEC International Level 3 qualifications in Land-based Studies are designed either for learners in the 16–19 age group, who wish to pursue a career in a land-based industry via higher education to access graduate entry employment within the land-based sector, or alternatively through a junior land-based employment role.

Which size qualification to choose?

Choosing the most suitable size of qualification will depend on the learner's broader programme of study. For example, a learner who wishes to focus solely on agriculture may take the Diploma or Extended Diploma, while a learner who selects a smaller qualification, such as the Certificate or Subsidiary Diploma, may choose units from across these disciplines and combine them with qualifications from other sectors, in order to support their desired progression. Smaller qualifications are also suitable for learners who are in employment and studying part-time.

Qualification structures have been designed to enable a learner who starts with the smallest qualification to progress easily to the larger qualifications.

What do these qualifications cover?

The content of these qualifications has been designed to support progression to particular roles in land-based industries, either directly into entry-level roles linked to these occupational areas or, more likely, via particular higher-education routes in the particular areas. The qualification content has been designed in consultation with employers, professional bodies and higher-education providers to ensure that the content is appropriate for the progression routes identified.

All learners will be required to take mandatory content that is directly relevant to progression routes in all of the identified areas.

In addition, learners take optional units that support the progression route identified in the qualification title. For example, learners taking the qualification as part of a work-based learning qualification in agriculture could take units such as:

- Animal Production Systems
- Crop Production
- Applied Agricultural Farming Practice
- Organic Agricultural Production.

Additionally, learners could choose units that relate to a number of roles in the sector but which contribute to their understanding of those roles in a vocational context, such as:

- Work Experience in the Land-based Sectors
- Specialist Tourism.

Or for example, learners taking the qualification as part of a work-based learning qualification in horticulture could take units such as:

- Identification, Planting and Care of Plants
- Maintenance of Sports and Amenity Turf
- Maintaining the Health and Quality of Turf in Parks and Gardens
- Participating in Horticultural Tasks at Events.

Additionally, learners could choose units that relate to a number of roles in the sector but which contribute to their understanding of those roles in a vocational context, such as:

- Work Experience in the Land-based Sectors
- Estate Skills.

Or for example, learners taking the qualification as part of a work-based learning qualification in land-based studies could take units such as:

- Farm Livestock Husbandry
- Crop Production
- Identification, Planting and Care of Plants
- Outdoor Horticultural Crop Production.

Additionally, learners could choose units that relate to a number of roles in the sector but which contribute to their understanding of those roles in a vocational context, such as:

- Wildlife Ecology and Conservation Management
- Estate Skills.

What could these qualifications lead to?

These qualifications support progression to job opportunities in the land-based industries at a variety of levels. Jobs available in agricultural areas include:

- stockperson
- herdsperson
- livestock contractor
- crop contractor
- agricultural technician
- arable operator
- farm mechanic
- unit manager (for example dairy, poultry).

Jobs available in horticultural areas include:

- horticultural commercial supervisor
- landscape site supervisor
- head gardener
- head groundsperson
- horticultural contract supervisor
- horticultural sales supervisor
- greenkeeper supervisor
- nursery assistant manager.

After achieving this qualification, while learners can progress directly to entry-level supervisory roles, it is likely that many will do so via higher study. This qualification is recognised by higher-education institutions as fully meeting admission requirements to many relevant courses in a variety of areas of the land-based sectors, for example:

- BSc (Hons) in Agriculture with Farm Business Management
- FdSc in Sports Fisheries and Aquaculture
- FdSc in Veterinary Nursing Science.

NB: learners should always check the entry requirements for degree programmes with the relevant higher-education provider.

How do these qualifications provide transferable employability skills?

In the BTEC International Level 3 units, there are opportunities during the teaching and learning phase to give learners practice in developing employability skills. Where we refer to employability skills in this specification, we are generally referring to skills in the following three main categories:

- **cognitive and problem-solving skills** – using critical thinking, approaching non-routine problems, applying expert and creative solutions, using systems and technology
- **interpersonal skills** – communicating, working collaboratively, negotiating and influencing, self-presentation
- **intrapersonal skills** – self-management, adaptability and resilience, self-monitoring and development.

There are also specific requirements in some units for assessment of these skills where relevant, for example where learners are required to undertake real or simulated activities. These skills are indicated in the units and in *Appendix 2: Transferable employability skills*.

How do the qualifications provide transferable knowledge and skills for higher education?

All BTEC International Level 3 qualifications provide transferable knowledge and skills that prepare learners for progression to university. The transferable skills that universities value include the ability to:

- learn independently
- research actively and methodically
- give presentations and be active group members.

BTEC learners can also benefit from opportunities for deep learning, where they are able to make connections across units and select areas of interest for detailed study. BTEC International Level 3 qualifications provide a vocational context in which learners can develop the knowledge and skills required for particular degree courses, including:

- effective writing
- analytical skills
- creative development
- preparation for assessment methods used in a degree.

2 Structure

Qualification structures

The structures presented below are for the following qualifications in this specification:

- Pearson BTEC International Level 3 Certificate in Land-based Studies
- Pearson BTEC International Level 3 Subsidiary Diploma in Land-based Studies
- Pearson BTEC International Level 3 Foundation Diploma in Agriculture
- Pearson BTEC International Level 3 Foundation Diploma in Horticulture
- Pearson BTEC International Level 3 Diploma in Agriculture
- Pearson BTEC International Level 3 Extended Diploma in Agriculture.

Pearson BTEC International Level 3 Certificate in Land-based Studies

Mandatory units

There is one mandatory unit assessed through a Pearson Set Assignment and two internal units. Learners must complete and achieve a Pass or above in all mandatory units.

Optional units

Learners must complete at least 120 GLH of optional units.

Pearson BTEC International Level 3 Certificate in Land-based Studies				
Unit number	**Unit title**	**GLH**	**Type**	**How assessed**
Mandatory units – learners complete all units				
1	Plant and Soil Science	**60**	**Mandatory**	Set assignment
Optional units – learners complete 120 GLH				
2	Estate Skills	**60**	**Optional**	Internal
3	Understanding Environmental Management	**60**	**Optional**	Set assignment
4	Developing a Land-based Enterprise	**60**	**Optional**	Set assignment
6	Land-based Business Improvements	**60**	**Optional**	Set assignment
7	Work Experience in the Land-based Sectors	**60**	**Optional**	Internal
10	Farm Livestock Husbandry	**60**	**Optional**	Internal
17	Crop Production	**60**	**Optional**	Internal
27	Identification, Planting and Care of Plants	**60**	**Optional**	Internal
38	Protected Horticultural Crop Production	**60**	**Optional**	Internal

Optional units – learners complete 120 GLH *continued*				
39	Outdoor Horticultural Crop Production	**60**	**Optional**	Internal
41	Wildlife Ecology and Conservation Management	**60**	**Optional**	Internal

Pearson BTEC International Level 3 Subsidiary Diploma in Land-based Studies

Mandatory units

There are two mandatory units, each assessed through a Pearson Set Assignment. Learners must complete and achieve a Pass or above in all mandatory units.

Optional units

Learners must complete 240 GLH of optional units.

Pearson BTEC International Level 3 Subsidiary Diploma in Land-based Studies				
Unit number	**Unit title**	**GLH**	**Type**	**How assessed**
Mandatory units group A – learners complete this unit				
1	Plant and Soil Science	**60**	**Mandatory**	Set assignment
Mandatory units group B – learners complete at least 60 GLH				
3	Understanding Environmental Management	**60**	**Optional**	Set assignment
6	Land-based Business Improvements	**60**	**Optional**	Set assignment
Optional units – learners complete at least 180 GLH				
2	Estate Skills	**60**	**Optional**	Internal
4	Developing a Land-based Enterprise	**60**	**Optional**	Set assignment
7	Work Experience in the Land-based Sectors	**60**	**Optional**	Internal
8	Animal Production Systems	**60**	**Optional**	Internal
10	Farm Livestock Husbandry	**60**	**Optional**	Internal
15	Livestock Health and Diseases	**60**	**Optional**	Internal
16	Livestock Nutrition	**60**	**Optional**	Internal
17	Crop Production	**60**	**Optional**	Internal
18	Crop Handling, Storage and Quality Assurance	**60**	**Optional**	Internal
26	Applied Agricultural Farming Practice	**120**	**Optional**	Internal
27	Identification, Planting and Care of Plants	**60**	**Optional**	Internal
28	Routine Plant Management	**60**	**Optional**	Internal
29	Plant Propagation Activities	**60**	**Optional**	Internal
30	Tree and Shrub Pruning and Maintenance	**60**	**Optional**	Internal
31	Nursery Stock Production	**60**	**Optional**	Internal

Optional units – learners complete at least 180 GLH *continued*				
32	Maintenance of Sports and Amenity Turf	**60**	**Optional**	Internal
38	Protected Horticultural Crop Production	**60**	**Optional**	Internal
39	Outdoor Horticultural Crop Production	**60**	**Optional**	Internal
41	Wildlife Ecology and Conservation Management	**60**	**Optional**	Internal

Pearson BTEC International Level 3 Foundation Diploma in Agriculture

Mandatory units

There are five mandatory units, of which four are assessed through a Pearson Set Assignment. Learners must complete and achieve a Pass or above in all mandatory units.

Optional units

Learners must complete at least four optional units.

Pearson BTEC International Level 3 Foundation Diploma in Agriculture				
Unit number	**Unit title**	**GLH**	**Type**	**How assessed**
Mandatory units – learners complete all units				
1	Plant and Soil Science	**60**	**Mandatory**	Set assignment
2	Estate Skills	**60**	**Mandatory**	Internal
3	Understanding Environmental Management	**60**	**Mandatory**	Set assignment
4	Developing a Land-based Enterprise	**60**	**Mandatory**	Set assignment
6	Land-based Business Improvements	**60**	**Mandatory**	Set assignment
Optional units – learners complete at least four units				
7	Work Experience in the Land-based Sectors	**60**	**Optional**	Internal
8	Animal Production Systems	**60**	**Optional**	Internal
9	International Poultry Production	**60**	**Optional**	Internal
10	Farm Livestock Husbandry	**60**	**Optional**	Internal
11	International Pig Production	**60**	**Optional**	Internal
12	International Sheep Production	**60**	**Optional**	Internal
13	International Beef Production	**60**	**Optional**	Internal
14	International Dairy Production	**60**	**Optional**	Internal
15	Livestock Health and Diseases	**60**	**Optional**	Internal
16	Livestock Nutrition	**60**	**Optional**	Internal
17	Crop Production	**60**	**Optional**	Internal
18	Crop Handling, Storage and Quality Assurance	**60**	**Optional**	Internal
23	Land-based Machinery Operations	**60**	**Optional**	Internal
26	Applied Agricultural Farming Practice	**120**	**Optional**	Internal

Pearson BTEC International Level 3 Foundation Diploma in Horticulture

Mandatory units

There are five mandatory units, of which four are assessed through a Pearson Set Assignment. Learners must complete and achieve a Pass or above in all mandatory units.

Optional units

Learners must complete four optional units.

Pearson BTEC International Level 3 Foundation Diploma in Horticulture				
Unit number	**Unit title**	**GLH**	**Type**	**How assessed**
Mandatory units – learners complete all units				
1	Plant and Soil Science	**60**	**Mandatory**	Set assignment
2	Estate Skills	**60**	**Mandatory**	Internal
3	Understanding Environmental Management	**60**	**Mandatory**	Set assignment
4	Developing a Land-based Enterprise	**60**	**Mandatory**	Set assignment
6	Land-based Business Improvements	**60**	**Mandatory**	Set assignment
Optional units – learners complete four units				
7	Work Experience in the Land-based Sectors	**60**	**Optional**	Internal
23	Land-based Machinery Operations	**60**	**Optional**	Internal
27	Identification, Planting and Care of Plants	**60**	**Optional**	Internal
28	Routine Plant Management	**60**	**Optional**	Internal
29	Plant Propagation Activities	**60**	**Optional**	Internal
30	Tree and Shrub Pruning and Maintenance	**60**	**Optional**	Internal
31	Nursery Stock Production	**60**	**Optional**	Internal
32	Maintenance of Sports and Amenity Turf	**60**	**Optional**	Internal
33	Pests and Disease in Plants	**60**	**Optional**	Internal
34	Identification, Planting and Care of Trees	**60**	**Optional**	Internal

Optional units – learners complete four units *continued*				
38	Protected Horticultural Crop Production	**60**	**Optional**	Internal
39	Outdoor Horticultural Crop Production	**60**	**Optional**	Internal

Pearson BTEC International Level 3 Diploma in Agriculture

Mandatory units

There are six mandatory units, of which five are assessed through a Pearson Set Assignment. Learners must complete and achieve a Pass or above in all mandatory units.

Optional units

Learners must complete at least five optional units.

Pearson BTEC International Level 3 Diploma in Agriculture				
Unit number	**Unit title**	**GLH**	**Type**	**How assessed**
Mandatory units – learners complete all units				
1	Plant and Soil Science	**60**	**Mandatory**	Set assignment
2	Estate Skills	**60**	**Mandatory**	Internal
3	Understanding Environmental Management	**60**	**Mandatory**	Set assignment
4	Developing a Land-based Enterprise	**60**	**Mandatory**	Set assignment
5	Operational and Environmental Activities in Land-based Enterprises	**60**	**Mandatory**	Set assignment
6	Land-based Business Improvements	**60**	**Mandatory**	Set assignment
Optional units – learners complete at least five units to a total of 360 GLH				
7	Work Experience in the Land-based Sectors	**60**	**Optional**	Internal
8	Animal Production Systems	**60**	**Optional**	Internal
9	International Poultry Production	**60**	**Optional**	Internal
10	Farm Livestock Husbandry	**60**	**Optional**	Internal
11	International Pig Production	**60**	**Optional**	Internal
12	International Sheep Production	**60**	**Optional**	Internal
13	International Beef Production	**60**	**Optional**	Internal
14	International Dairy Production	**60**	**Optional**	Internal
15	Livestock Health and Diseases	**60**	**Optional**	Internal
16	Livestock Nutrition	**60**	**Optional**	Internal
17	Crop Production	**60**	**Optional**	Internal
18	Crop Handling, Storage and Quality Assurance	**60**	**Optional**	Internal

Optional units – learners complete at least five units to a total of 360 GLH *continued*				
19	Combinable Crop Production and Processing	**60**	**Optional**	Internal
20	Grass and Forage Crop Production	**60**	**Optional**	Internal
21	Root Crop and Field Vegetable Production	**60**	**Optional**	Internal
22	Organic Agricultural Production	**60**	**Optional**	Internal
23	Land-based Machinery Operations	**60**	**Optional**	Internal
24	Land-based Workshop Practices	**60**	**Optional**	Internal
25	Selecting and Managing Land-based Machinery	**60**	**Optional**	Internal
48	Specialist Tourism	**60**	**Optional**	Internal

Pearson BTEC International Level 3 Extended Diploma in Agriculture

Mandatory units

There are six mandatory units, of which five are assessed through a Pearson Set Assignment. Learners must complete and achieve a Pass or above in all mandatory units.

Optional units

Learners must complete at least 11 optional units.

Pearson BTEC International Level 3 Extended Diploma in Agriculture				
Unit number	**Unit title**	**GLH**	**Type**	**How assessed**
Mandatory units – learners complete all units				
1	Plant and Soil Science	**60**	**Mandatory**	Set assignment
2	Estate Skills	**60**	**Mandatory**	Internal
3	Understanding Environmental Management	**60**	**Mandatory**	Set assignment
4	Developing a Land-based Enterprise	**60**	**Mandatory**	Set assignment
5	Operational and Environmental Activities in Land-based Enterprises	**60**	**Mandatory**	Set assignment
6	Land-based Business Improvements	**60**	**Mandatory**	Set assignment
Optional units – learners complete at least 11 units to a total of 720 GLH				
7	Work Experience in the Land-based Sectors	**60**	**Optional**	Internal
8	Animal Production Systems	**60**	**Optional**	Internal
9	International Poultry Production	**60**	**Optional**	Internal
10	Farm Livestock Husbandry	**60**	**Optional**	Internal
11	International Pig Production	**60**	**Optional**	Internal
12	International Sheep Production	**60**	**Optional**	Internal
13	International Beef Production	**60**	**Optional**	Internal
14	International Dairy Production	**60**	**Optional**	Internal
15	Livestock Health and Diseases	**60**	**Optional**	Internal
16	Livestock Nutrition	**60**	**Optional**	Internal
17	Crop Production	**60**	**Optional**	Internal
18	Crop Handling, Storage and Quality Assurance	**60**	**Optional**	Internal

Optional units – learners complete at least 11 units to a total of 720 GLH *continued*				
19	Combinable Crop Production and Processing	**60**	**Optional**	Internal
20	Grass and Forage Crop Production	**60**	**Optional**	Internal
21	Root Crop and Field Vegetable Production	**60**	**Optional**	Internal
22	Organic Agricultural Production	**60**	**Optional**	Internal
23	Land-based Machinery Operations	**60**	**Optional**	Internal
24	Land-based Workshop Practices	**60**	**Optional**	Internal
25	Selecting and Managing Land-based Machinery	**60**	**Optional**	Internal
26	Applied Agricultural Farming Practice	**120**	**Optional**	Internal
48	Specialist Tourism	**60**	**Optional**	Internal

Pearson Set Assignment units

This is a summary of the type and availability of Pearson Set Assignment units. For more information, see *Section 5 Assessment structure*, and the units and sample assessment materials.

Unit	Type	Availability
Unit 1: Plant and Soil Science	• An assignment set by Pearson and marked by the centre. • The advised period is 13 hours.	Two available for each series.
Unit 3: Understanding Environmental Management	• An assignment set by Pearson and marked by the centre. • The advised period is 13 hours.	Two available for each series.
Unit 4: Developing a Land-based Enterprise	• An assignment set by Pearson and marked by the centre. • The advised period is 12 hours.	Two available for each series.
Unit 5: Operational and Environmental Activities in Land-based Enterprises	• An assignment set by Pearson and marked by the centre. • The advised period is 14 hours.	Two available for each series.
Unit 6: Land-based Business Improvements	• An assignment set by Pearson and marked by the centre. • The advised period is 3 hours.	Two available for each series.

Employer involvement in assessment and delivery

You are encouraged to give learners opportunities to be involved with employers. For more information, please see *Section 4 Planning your programme*.

3 Units

Understanding your units

The units in this specification set out our expectations of assessment in a way that helps you to prepare your learners for assessment. The units help you to undertake assessment and quality assurance effectively.

Each unit in the specification is set out in a similar way. This section explains how the units work. It is important that all teachers, assessors, internal verifiers and other staff responsible for the programme review this section.

Section	Explanation
Unit number	The number is in a sequence in the sector. Numbers may not be sequential for an individual qualification.
Unit title	This is the formal title that we always use, it appears on certificates.
Level	All units are at Level 3.
Unit type	This shows if the unit is internal or assessed using a Pearson Set Assignment. See structure information in *Section 2 Structure* for details.
Guided Learning Hours (GLH)	Units may have a GLH value of 120 or 60. This indicates the numbers of hours of teaching, directed activity and assessment expected. It also shows the weighting of the unit in the final qualification grade.
Unit in brief	This is a brief formal statement on the content of the unit that is helpful in understanding its role in the qualification. You can use this in summary documents, brochures, etc.
Unit introduction	This is written with learners in mind. It indicates why the unit is important, how learning is structured and how it might be applied when they progress to employment or higher education.
Assessment	For internal Pearson Set Assignment units, this section states whether set assignments are required to be completed.
Learning aims	These help to define the scope, style and depth of learning of the unit. You can see where learners should be learning standard requirements ('understand') or where they should be actively researching ('investigate'). You can find out more about the verbs we use in learning aims in *Appendix 3: Glossary of terms used*.
Summary of unit	This section helps teachers to see at a glance the main content areas given against the learning aims and the structure of the assessment. The content areas and structure of assessment must be covered. The forms of evidence given are suitable to fulfil the requirement.

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Section	Explanation
Content	This section sets out the required teaching content of the unit. Content is compulsory except when shown as 'e.g.'. Learners should be asked to complete summative assessment only after the teaching content for the unit or learning aim(s) has been covered.
Assessment criteria	Each learning aim has Pass and Merit criteria. Each assignment has at least one Distinction criterion. A full glossary of terms used is given in *Appendix 3: Glossary of terms used.* All assessors need to understand our expectations of the terms used. Distinction criteria represent outstanding performance in the unit. Some criteria require learners to draw together learning from across the learning aims.
Essential information for assignments	This shows the maximum number of assignments that may be used for the unit to allow for effective summative assessment and how the assessment criteria should be used to assess performance. For Pearson Set Assignment units, this section will include any conditions for taking the assignment.
Further information for teachers and assessors	This section gives you information to support the implementation of assessment. It is important that this is read carefully alongside the assessment criteria, as the information will help with interpretation of the requirements.
Resource requirements	Any specific resources that you need to be able to teach and assess are listed in this section. For information on support resources, see *Section 10 Resources and support*.
Essential information for assessment decisions	This section gives guidance on and examples for each learning aim or assignment of the expectations for Pass, Merit and Distinction standard.
Assessment controls	This section gives details of the rules that learners need to abide by when taking the assessment.
Links to other units	This section shows you the main relationships between different units. This helps you to structure your programme and make best use of available materials and resources.
Employer involvement	This section gives you information on the units, which can be used to involve learners with employers. This will help you to identify the kind of involvement that is likely to be most successful.
Opportunities to develop transferable employability skills	This section gives you guidance on how transferable employability skills might be developed in teaching and assessment of the unit.

Index of units

This section contains all the units developed for these qualifications. Please refer to *pages 14–24* to check which units are available in all qualifications in the land-based studies sector.

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Unit 1: Plant and Soil Science

Level: **3**
Unit type: **Internal set assignment**
Guided learning hours: 60

Unit in brief

Learners study the structural and functional features of plants and soils that inform land management practices.

Unit introduction

Plants are one of the most amazing and varied living organisms on our planet. They supply us with our oxygen, provide us with food and shape our landscape. Understanding how plants grow and what they need to grow successfully is essential in being able to manage them in a range of sectors and for a broad range of purposes. This includes growing crops for people or livestock, growing decorative plants and providing environments for leisure or habitat conservation.

In this unit, you will develop an understanding of external and internal plant structures, including plant cells. You will learn about the relationship between these structures and their function, such as how they obtain their nutrition and how they reproduce. You will gain an understanding of the important life processes of plants and how these are affected by the environment they are in. You will learn about the physical and chemical characteristics of soil. You will also learn about different types of soil, their characteristics and the nutrition in soils that is essential for plants to ensure successful plant growth.

The knowledge and skills you gain in this unit are fundamental to any role where you grow, plant, manage or establish plants. Whether you are working in forestry, arable farming, sports turf, landscaping or gardening, this unit will give you a foundation for further study at higher education and help you to progress to a role in your chosen sector.

Assessment

This unit has a Pearson Set Assignment. Learners must complete a Pearson Set Assignment Brief.

Learning aims

In this unit you will:

A Understand plant structures and systems

B Understand the importance and use of soil

C Understand management of plant growth media.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Understand plant structures and systems	**A1** Plant cell structure and specialisations **A2** Plant structure and function **A3** Plant processes **A4** Plant nutrition **A5** Reproduction systems	This unit is assessed through a Pearson Set Assignment.
B Understand the importance and use of soil	**B1** Soil types and texture **B2** Soil structure **B3** Biological and chemical activities affecting soil health and fertility **B4** Soil acidity and alkalinity	
C Understand management of plant growth media	**C1** Soil management	

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Content

Learning aim A: Understand plant structures and systems

Structures and functions of plants, including cells, life processes and their role in the growing of healthy plants.

A1 Plant cell structure and specialisations

Structure and function of plant cells and their components, linked to their role and location.

- Cell structure and organelles: cell wall, plasma membrane, nucleus, vacuole, cytoplasm, ribosome, mitochondria, chloroplasts.
- Cell specialisations: root, stem, leaf.

A2 Plant structure and function

Functions of plant structures in relation to plant growth and development, including changes to seasonal conditions.

- Root and stem structure:
  - root structure, including fibrous, adventitious and taproot system; functions, including anchorage, osmosis and absorption of minerals, transport system to plant, food storage
  - storage organs, including bulbs, corms, rhizomes, tubers
  - shoot structure, stem characteristics, node, internode, lateral bud, terminal bud; leaf arrangements, including alternate, opposite and whorled, lenticel; function, including support, bear leaves, transport system of water and nutrients around the plant, growth
  - vascular bundles, including xylem, phloem, cambium.
- Leaf structure:
  - leaf characteristics, petiole, lamina, margin, midrib, apex, base
  - leaf types, including simple and compound, petiolated and sessile, leaf shapes.

A3 Plant processes

Processes and requirements for healthy plant growth, including the features, structure and function of relevant plant tissues.

- Photosynthesis, including:
  - role of chloroplast structure and chlorophylls
  - factors influencing the rate of photosynthesis, to include temperature, carbon dioxide levels, leaf colour, leaf area, light availability, water supply, nutrients.
- Respiration:
  - aerobic and anaerobic respiration
  - factors influencing respiration rates, including temperature, oxygen, light, carbon dioxide, water availability, plant growth.
- The role of osmosis in turgidity, flaccidity and plasmolysis.
- Diffusion of carbon dioxide, oxygen and water vapour into and out of plants.
- Translocation in the phloem.
- Transpiration in the xylem:
  - factors affecting transpiration, including the sun, air temperature, humidity, air movement, water supply
  - guard cells and stomata, including regulation of opening and closing to facilitate gas exchange and control transpiration in plants.

A4 Plant nutrition

Nutritional requirements for growth and development of healthy plants.

- Role of the nutrients required for plant growth:
  - macronutrients – nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S)
  - micronutrients – boron (B), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn).
- Effects of the lack of macro and micronutrients and how these are shown in plants:
  - signs of deficiencies, chlorosis of the leaves, stunted growth, distorted foliage, aborted flowers or pods, absence of flowering, fruiting, weak stems, leaf striping, leaf spotting, necrosis or plant death
  - causes of nutritional deficiencies, soil pH, leaching, drought.

A5 Reproduction systems

- Structure and function of reproductive parts of flowering plants:
  - differences between dioecious, monoecious and hermaphrodite flowering plants
  - parts of the flower, receptacle, calyx, corolla, perianth, pedicel, peduncle, bract
  - androecium, including filament, anther
  - gynoecium – carpels, ovary, style, stigma.
- Pollination processes:
  - self-pollination and cross-pollination
  - entomophilous pollination and anemophilous pollination and pollen transfer.
- Germination:
  - parts of the seed, testa, embryo, including cotyledon(s), epicotyl, plumule, hypocotyl, radicle
  - seed dispersal systems, dormancy, viability, vigour
  - hypogeal germination
  - epigeal germination
  - factors that affect successful germination, including age of seed, light, air, moisture, temperature and viability.
- Asexual reproduction, including rhizome and stolons.

Learning aim B: Understand the importance and use of soil

The characteristics of soil and the importance of soil fertility in relation to plant health and successful growth.

B1 Soil types and texture

- Soil types, to include sand, silt, clay, chalk, peat and loam.
- Soil texture:
  - soil particles for sand, silt, clay and loam, including water-holding capacity, permeability, workability, organic matter
  - soil grading and particle sizes, including use of hand texturing.

B2 Soil structure

- Soil profiles and horizons in relation to rooting depths, including aggregates, topsoil, subsoil, parent rock.
- Effects of weathering on soil:
  - physical, chemical and biological effects on soil formation.

B3 Biological and chemical activities affecting soil health and fertility

Impact on soil health, fertility and plant growth of biological and biochemical activities.

- Indicators of good soil fertility and impact on soil health:
  - interaction of animals and vegetation with soil and links to biological weathering
  - role of organisms in improving soil condition and health
  - living organisms in the soil profile – slugs, snails, earthworms, woodlice, springtails, beetles and nematodes.
- Sources and cycles of carbon and nitrogen.

B4 Soil acidity and alkalinity

- Effects on plant and root growth:
  - plant health, nutrient availability, microbial activity, plant yield.
- Interpretation of pH scale test results.
- Causes of changes in soil acidity and alkalinity:
  - applications of lime, aluminium sulfate, ferrous sulfate, organic matter.

Learning aim C: Understand management of plant growth media

C1 Soil management

Managing soil for optimum plant growth in indoor and outdoor soils, including protective environments, gardens, fields and sports turf.

- Soil aeration: purpose and methods.
- Integration of organic matter: purpose and methods.
- Irrigation methods, including water conservation: recycling and rain capture, plant choice, application timings, use of moisture-sensing equipment/ computer control.
- Soil drainage methods, including changes to soil texture, water courses and ditches.
- Characteristics of fertilisers:
  - nitrogen (N), phosphorus (P) and potassium (K) ratios
  - length of nutrient release related to fertiliser form
  - application methods for fertilisers.
- Adjusting soil acidity and alkalinity: purpose and methods.
- Effects of over application of fertiliser on soil health and plant growth.
- Impact on environment of fertiliser leaching.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Understand plant structures and systems</td><td rowspan="2">A.D1 Produce a detailed explanation of the role of plant structures in plant processes.</td></tr>
<tr><td>A.P1 Outline common plant structures.
A.P2 Describe common plant processes.</td><td>A.M1 Explain the function and/or importance of common plant structures and processes.</td></tr>
<tr><td colspan="2">Learning aim B: Understand the importance and use of soil</td><td rowspan="4">BC.D2 Plan, in detail, to maximise the growth of a named plant and retain the fertility of the soil.</td></tr>
<tr><td>B.P3 Identify the factors affecting the structure and composition of soil.
B.P4 Explain the factors that impact on the fertility of soil.</td><td>B.M2 Analyse the suitability of a soil to grow plants.</td></tr>
<tr><td colspan="2">Learning aim C: Understand management of plant growth media</td></tr>
<tr><td>C.P5 Identify ways in which soil can be managed for plant growth.</td><td>C.M3 Explain methods of maximising plant growing conditions in soil.</td></tr>
</table>

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Essential information for assignments

This unit is assessed using a Pearson Set Assignment Brief. A set assignment must be used to assess learners.

Further information for teachers and assessors

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners must provide a detailed explanation of the role of plant structures and how they impact on plant processes. Learners' work may include specific examples or details of modifications that enable greater efficiency in certain growing conditions.

For Merit standard, learners must explain the importance and/or function of key structures and processes in the plant. Explanations will show clarity in the communication of key technical terms and names. It is expected that learners will make connections between structures and the processes to which they link. These are likely to include all phases of plant growth, from germination through to reproduction and fruiting.

For Pass standard, learners must identify key common features in plant structures. It is also expected that they know the role and operational order in common plant growth and development processes. This is likely to be shown through their ability to draw plant structures and provide clear labelling. Similarly, they should be able to write a short narrative that outlines the processes involved in plant growth. The level of detail will be appropriate to the level of this qualification (i.e. Level 3) and will not require the knowledge of complex biochemical reactions.

Learning aims B and C

For Distinction standard, learners must use knowledge of optimal soil conditions for plant growth and demonstrate how a soil could be managed to meet this requirement. This will result in a detailed plan that provides clear justification for the recommendations made, showing how these activities will impact on plant growth. It is also expected that the plan will provide detail on how the fertility and health of the soil will be maintained while optimising plant growth.

For Merit standard, learners must analyse a soil and evaluate its suitability for growing plants. They will also make recommendations to improve plant growth as a result of their evaluation. This is likely to be demonstrated in relation to the needs of a specific plant/crop.

For Pass standard, learners must identify the factors affecting the formation of soil and also the way in which the composition of the soil will impact on the growth of plants and the soil's future fertility. Learners will have knowledge of the important nutrients required for plant growth and understand the implications of the shortage of these nutrients.

An investigation of soil pH will enable learners to understand its impact on the availability of plant nutrients.

Learners will also have an understanding of how the soil may be managed for optimum growth and ways in which the fertility of the soil may be retained.

Assessment controls

Time: this assignment has a recommended time period. This is for advice only and can be adjusted depending on the needs of learners.

Supervision: you should be confident of the authenticity of learner's work. This may mean that learners be supervised.

Resources: all learners should have access to the same types of resources to complete the assignment.

Research: learners should be given the opportunity to carry out research outside of the learning context if required for the assignment.

Links to other units

This is an underpinning unit for the qualifications.

Opportunities to develop transferable employability skills

Learners will have opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills
- presentation skills
- written and verbal communication skills.

Unit 2: Estate Skills

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills needed to manage and maintain habitats, structures, surfaces, boundaries and services that are found in the land-based sector.

Unit introduction

Managing the physical environment of the land-based sectors means you need to be able to maintain, repair and install a variety of different structures, surfaces, boundaries and services, as well as maintain habitats, ensuring that work is carried out efficiently and safely.

In this unit, you will develop the knowledge and skills needed to manage the repair, maintenance and installation of the fabric of businesses and organisations working in the land-based sectors. These include forestry, horticulture and agriculture as well as more general countryside management. You will learn to plan, implement and reflect on maintenance tasks, including those you carry out yourself and those completed by others such as staff or professional contractors whose work you will manage. In this unit, you will draw on your learning from across the programme to complete assessment tasks.

This unit will give you the skills required to progress to employment as a trainee farm or forestry worker, garden centre assistant or as part of an estate management team. It is also an excellent introduction to a degree in estate management.

Learning aims

In this unit you will:

A Explore estate skills for the management and maintenance of habitats and environments

B Undertake estate skills and their management in the land-based sector

C Carry out the supervision of others engaged in maintenance, repair and installation tasks in the land-based sector.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore estate skills for the management and maintenance of habitats and environments	**A1** The nature and scope of estate skills for land-based sector management **A2** Assessing needs **A3** Planning tasks	A portfolio of evidence that plans for estate management projects. The portfolio should include: • surveys • relevant legislation and codes of practice • a plan, including schedules and specifications.
B Undertake estate skills and their management in the land-based sector	**B1** Working safely **B2** Practical estate tasks **B3** Reflecting on tasks undertaken	Evidence of tasks carried out and reflection on task outcomes, to include: • logbooks, observation records and witness statements of tasks undertaken • a review of task outcomes.
C Carry out the supervision of others engaged in maintenance, repair and installation tasks in the land-based sector	**C1** Workforce supervision **C2** Supervise estate skills undertaken **C3** Evaluate estate skills tasks completed	Evidence of the supervision of others in carrying out tasks, to include: • an evaluation framework that includes task outcome and workforce supervision • observation records and witness statements that demonstrate supervision and management of scheduled tasks • a review of the outcomes of tasks carried out by others • a review of own supervision of a workforce.

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Content

Learning aim A: Explore estate skills for the management and maintenance of habitats and environments

A1 The nature and scope of estate skills for land-based sector management

Understanding the form and function of estate skills elements that are found in the land-based sector.

- Boundaries, including:
  - animal deterrent fencing, electric fencing, stock fencing, and post and rail fencing
  - decorative fencing.
- Surfaces, including:
  - paths, tracks, rides, accommodation flooring, grassed surfaces
  - drainage of surfaces, including field drains.
- Structures to provide for land-based management, including:
  - field structures, e.g. field shelters, stiles and way markers, greenhouses, cold frames, raised beds
  - gates and water troughs
  - internal structures, e.g. drinkers, stall furniture and feeders
  - finishes, including paints, varnishes and preservatives.
- Habitat maintenance for land-based management, including:
  - e.g. weed and invasive plant control, scrub clearance, shrub boundary cutting/layering
  - wildlife refuges, e.g. nesting/resting boxes, woodpiles, animal tunnels.
- Supply, distribution or storage of mains services and utilities, including:
  - water and gas, including bottled gas, electricity, fuel, oil
  - sewerage, including mains, cesspit and septic tank.
- Materials, tools and construction methods used for estate skills tasks:
  - basic construction materials, e.g. wood, concrete, woodchip, tarmac, type 1 aggregate, fencing, galvanised sheets, polypropylene piping
  - common specialist tools and basic test equipment, e.g. circuit tester
  - fixtures and fittings, e.g. hinges, locks, ball valves, pipe connections
  - selection, transport, maintenance and storage of tools, materials and equipment.

A2 Assessing needs

Inspection of boundaries, surfaces, structures, services and habitats.

- Inspecting boundaries, surfaces, habitats and structures for their maintenance, repair, construction and installation needs.
- Inspection and basic fault-finding of electrical circuits and devices using non-contact test equipment.
- Inspection of drainage, gas and water services for leaks and blockages.
- Methods and processes for reporting inspection findings, to include verbal and written, use of appropriate maps, plans and diagrams.

A3 Planning tasks

The application of regulations and specific, current regulations and guidance notes relevant to estate skills for land-based management, including health and safety at work and those relating to animal welfare.

- Government welfare codes of practice for specific animals and plants.
- Use of risk assessments, their purpose and types, including static, dynamic, qualitative and quantitative.
- Correct selection and use of personal protective equipment (PPE).
- Assessing the task, including measuring, estimating, use of maps, diagrams and plans.
- Creating and using schedules of tasks.
- Job specifications, to include job description and rationale, timescales, tools, equipment, materials, location of work, costs, skill sets, health and safety considerations, environmental issues and supervising arrangements.
- Sourcing tools, equipment, materials, skill sets, e.g. internal workforce, external contractors.
- Processes and aids to planning tasks, including budgets, schedules and flow charts.
- The use of IT in raising and monitoring repair and maintenance tasks.
- Communications with contractors and employees to ensure efficient planning.

Learning aim B: Undertake estate skills and their management in the land-based sector

B1 Working safely

- Compliance with appropriate health and safety regulations and guidance, e.g. PPE, animal welfare.
- Selection of the correct tools, equipment and materials.
- Transportation of tools, equipment and materials.
- Preparation of the work area.
- Correct and safe use of tools and equipment.
- Waste disposal in accordance with regulations.
- Maintaining and storing tools, equipment and materials.

B2 Practical estate tasks

Maintenance, repair, construction and installation of:

- boundaries, to include post and rail fencing, shrub boundaries, electric fencing and strained fencing, e.g. stock or chain-link fencing
- surfaces, to include aggregate or concrete, woodchip, wood, sand or artificial products, e.g. woodchip or grassed paths, forest access roads, ornamental paving
- structures, e.g. greenhouses, field shelters, gates, stalls, troughs, feeders, stiles, signage
- drainage, e.g. unblocking drains or field drains, clearing an open ditch
- isolation of mains services in the event of leaks or for maintenance, repair, construction and installation tasks

- basic repair of electrical appliances or circuits, e.g. changing a plug or fuse, resetting a circuit
- use of basic equipment to locate underground or hidden services
- installation of temporary electric supply for both indoor and outdoor power requirements, e.g. extension leads, electric fence batteries, small generators
- repair, maintenance or installation of systems to supply water, e.g. to a water trough, irrigation system or to allow a tap and hose to be connected to an existing system
- habitats, e.g. brush clearance, shrub boundary, cutting, construction of wildlife refuges.

B3 Reflecting on tasks undertaken

Process for reviewing the tasks undertaken to assess the impact on land-based management, to include:

- matching skills to tasks
- taking account of problems that arise and using problem-solving techniques
- comparing the time taken with the time allocated and the time needed
- identifying inefficient working practices
- monitoring actual costs against estimates and identifying cost overruns
- examining specifications to improve clarity and eliminate ambiguity
- monitoring compliance with regulations, guidance and advice notes
- assessing communication to identify improvements.

Learning aim C: Carry out the supervision of others engaged in maintenance, repair and installation tasks in the land-based sector

C1 Workforce supervision

- Identifying skill sets, e.g. internal workforce, external contractors.
- Communicating maintenance, repair, construction and installation needs to in-house teams and outside contractors, to include raising orders, issuing instructions orally and in writing, getting estimates and quotations, commissioning contractors and understanding contracts.
- Using written communication skills:
  - using correct spelling, punctuation and grammar
  - adopting different styles, including formal and informal.
- Using oral communication skills:
  - using tone, inflexion and style when speaking
  - using aids, e.g. maps and plans.

C2 Supervise estate skills undertaken

- Ensuring the work is proceeding according to expectations, e.g. site visits, problem solving and evaluating the progress of estate skills tasks, ensuring compliance with specifications, checking the progress of work against the specification, regulations and codes of practice and risk assessments.
- Using problem-solving skills to assess issues, examine alternative solutions, decide on a course of action, implement solutions and monitor outcomes.

C3 Evaluate estate skills tasks completed

Using evaluation frameworks to enable assessment of completed tasks and workforce management.

- Creating evaluation frameworks using details of the original specification as a checklist.
- Evaluating completed products, including compliance with specifications, regulations, and codes of practice and risk assessments.
- Communicating evaluation outcomes, ensuring correct task completion, including situations where there is a dispute.
- Creating evaluation frameworks for assessing workforce management, to include:
  - selection of workforce
  - communication of task
  - supervision of work in progress
  - application of problem-solving skills
  - feeding back on outcomes of task.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Explore estate skills for the management and maintenance of habitats and environments		
A.P1 Explain findings of own surveys undertaken to establish estate skills needs. **A.P2** Select information from the findings of own surveys undertaken to plan for the management of an estate skills task.	**A.M1** Analyse the results of own surveys undertaken to produce a schedule for the management of estate skills tasks.	**A.D1** Evaluate the likely impact of the schedule produced for the management of estate skills tasks resulting from own surveys undertaken.
Learning aim B: Undertake estate skills and their management in the land-based sector		
B.P3 Perform simple estate skills tasks to an agreed specification. **B.P4** Explain how own estate skills tasks undertaken meet job specifications.	**B.M2** Perform complex estate skills tasks to an agreed specification and within an agreed timescale. **B.M3** Assess own performance in carrying out estate skills tasks to meet job specifications.	**B.D2** Evaluate the standard of own estate skills tasks undertaken in relation to job specifications.
Learning aim C: Carry out the supervision of others engaged in maintenance, repair and installation tasks in the land-based sector		
C.P5 Demonstrate the management and supervision of a simple estate skills task. **C.P6** Explain the effectiveness of own workforce supervision of an estate skills task.	**C.M4** Demonstrate the management and supervision of a complex estate skills task. **C.M5** Analyse the effectiveness of own workforce supervision of an estate skills task, identifying areas for improvement.	**C.D3** Evaluate the effectiveness of own workforce supervision of a complex estate skills task, detailing improvements.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of three summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aim: B (B.P3, B.P4, B.M2, B.M3, B.D2)

Learning aim: C (C.P5, C.P6, C.M4, C.M5, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of common and specialist hand tools, including power tools and testing equipment
- suitable PPE
- a wide range of suitable estate skills tasks, including the provision of mains and temporary services.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will conduct surveys of land-based establishments. They will use a range of appropriate test equipment independently and proficiently. They will readily understand complex estate skills issues, considering causes and making connections with usage and consequences if unaddressed, exploring the situation thoroughly. Learners will present meticulous findings in the form of annotated maps, plans, diagrams and accompanying notes. They will be assured in their assessment of issues and their decisions in respect of repair, maintenance or installation needs.

Learners will produce comprehensive and flexible plans, reprioritising tasks where appropriate in order to use time and resources efficiently. Plans will include a detailed appraisal of work required and a thoroughly considered, time-specific schedule of work. Learners will give a clear rationale for all their recommendations, demonstrating detailed awareness of the influence of relevant governing legislation and codes of practice, and the impact on the establishment if the work is delayed or not completed. Job specifications produced will be comprehensive. Learners will show that they have considered how their plans will be effective in terms of, for example, use of resources, completion of tasks, meeting identified needs.

For Merit standard, learners will conduct surveys of land-based establishments. They will use a range of appropriate test equipment safely and without supervision. They will interrogate the causes of issues, suggesting remedial action and, where appropriate, prevention in relation to repair, maintenance or installation needs. They will explore the complexity of faults and issues, considering less obvious factors. Learners will present detailed findings in the form of annotated maps, plans, diagrams and accompanying notes.

Learners will plan proactively with clear timescales for repair, maintenance and installation needs. Their plans will clearly demonstrate an understanding of the need to prioritise work, and an appreciation of realistic timescales and resources. Their planning will demonstrate a detailed assessment of the work required and a time-specific schedule of work. Consideration will be given to relevant governing legislation and codes of practice. Job specifications produced will be clear and detailed.

For Pass standard, learners will conduct surveys of land-based establishments. They will use a range of appropriate test equipment, under supervision where necessary. Learners will understand major issues and correctly identify methods of repair, maintenance or installation. They will record correct findings appropriate to each situation surveyed, presenting the information in the form of annotated maps, plans, diagrams and accompanying notes. The notes and annotations will give clear reasoning for their findings.

Learners' plans will address key repair, maintenance and installation needs, correctly prioritising works using broad timescales. Where appropriate, their plans will take into account governing legislation and codes of practice. Job specifications produced will contain key information.

Learning aim B

For Distinction standard, learners will carry out complex tasks that require multiple operations, using appropriate equipment and a variety of tools and materials. Tasks will be undertaken efficiently, accurately and completely, meeting the specification. Learners will work to a professional industry standard and they will comply with best workplace practice.

Learners will review the qualitative standard of practical work undertaken to improve the completion of tasks, supporting their views with reasoned judgements.

For Merit standard, learners will carry out complex tasks that require multiple operations, using appropriate equipment and a variety of tools and materials. Tasks will be undertaken efficiently, accurately and completely, meeting the specification. Learners will work to the standard of a competent employee. They will carry out complex tasks that require the installation, maintenance or repair of boundaries, surfaces, habitats and either mains or temporary services.

Learners will demonstrate best workplace practice by working safely and in accordance with relevant legislation, ensuring the workplace is prepared and cleared. They will understand the need for, and demonstrate, correct tool, material and equipment procedures, including selection, use, transport, maintenance and storage.

Learners will review their work in light of the job specification and the standard achieved, giving valid suggestions for improvements in tasks.

For Pass standard, learners will carry out simple estate skills tasks, requiring few operations and a limited range of tools and materials. Tasks will be undertaken efficiently, accurately and completely, meeting the specification. They will work to the standard of a novice employee. Learners will carry out simple tasks that require the installation, maintenance or repair of boundaries, surfaces, habitats and either mains or temporary services. Learners will demonstrate acceptable workplace practice by working safely and in accordance with relevant legislation, ensuring the workplace is cleared after task completion. They will demonstrate correct tool, material and equipment procedures, including selection, use, transport, maintenance and storage.

Learners will review their work in light of the job specification.

Learning aim C

For Distinction standard, learners will carry out effective and comprehensive workforce supervision that demonstrates clear, concise, unambiguous, oral and written communications suited to the recipient, such as contractors or colleagues.

Learners will delegate responsibilities appropriately according to skill sets and resources. They will monitor and assess task progression, advising only when necessary, using positive and flexible problem-solving skills when needed. They will assess the completed task against the specification and communicate their findings concisely and assertively.

Learners will draw up a valid and reliable evaluation framework to use when assessing their management of completed tasks. They will identify specific areas where their management of the task could have improved efficiency, safety or cost-effectiveness, and will make valid recommendations that would achieve this.

For Merit standard, learners will demonstrate that they can communicate clearly and appropriately with a workforce, such as contractors or colleagues, both orally and in writing. Learners will delegate responsibilities. They will accurately assess the progress of a complex task and demonstrate problem-solving skills when needed. They will communicate appropriately their assessment of the progress of a task.

Learners will draw up an accurate evaluation framework to use when assessing workforce management. They will make recommendations for improvements in their own performance.

For Pass standard, learners will demonstrate that they can issue simple workforce instructions, both orally and in writing.

Learners will carry out supervision of tasks, including checks on progress and identifying obvious issues that may hinder task completion to the specification. Where problems occur, learners will make suggestions and may intervene directly. Learners will provide basic feedback to the workforce on the progress of the task.

Learners will draw up a simple evaluation framework to use when assessing their management of the workforce, identifying their own strengths and weaknesses.

Links to other units

This unit links to *Unit 7: Work Experience in the Land-based Sectors*.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and supervision skills
- practical application when reflecting upon experiences of installing new structures
- safe working practices and procedures when working.

Unit 3: Understanding Environmental Management

Level: **3**
Unit type: **Internal set assignment**
Guided learning hours: **60**

Unit in brief

Learners will develop the skills and knowledge required to interpret management of landscapes and the environment, and the factors that affect this.

Unit introduction

In order to work in any aspect of the land-based sector, a good knowledge and understanding of different landscapes and environments are required. To best manage and maintain land and the environment, it is essential that the factors that affect and threaten them are understood.

In this unit, you will learn about the features of different landscapes and different environments, and their importance. You will investigate the external and internal factors that affect and threaten them, and the species within them. You will research the implications of the loss of different landscapes and environments.

This unit will prepare you for employment in the land-based sector in a variety of roles. It will enable you to progress to a higher-education course such as a degree in land-based business management.

Assessment availability

This unit has a Pearson Set Assignment. Learners must complete a Pearson Set Assignment Brief.

Learning aims

In this unit you will:

A Explore the ecology and conservation of different environments
B Understand human impacts on different environments
C Examine influences and management strategies for weather hazards.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore the ecology and conservation of different environments	**A1** Ecology of land-based ecosystems **A2** Conserving biodiversity in ecosystems through growth, development and change	This unit is assessed through a Pearson Set Assignment.
B Understand human impacts on different environments	**B1** Environmental impacts of agriculture and horticulture on ecosystems **B2** Other human impacts on the environment	
C Examine influences and management strategies for weather hazards	**C1** Weather hazards **C2** Managing the impact of weather hazards	

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Content

Learning aim A: Explore the ecology and conservation of different environments

A1 Ecology of land-based ecosystems

- Main abiotic and biotic features:
  - grassland
  - forests
  - wetlands
  - coastal/aquatic environments.
- Changes in habitats and impacts on flora and fauna, e.g. desertification, deforestation, pollution, impacts of invasive and non-native species:
  - grassland
  - forests
  - wetlands
  - coastal/aquatic environments.

A2 Conserving biodiversity in ecosystems through growth, development and change

- Awareness of links between different species and the need to manage numbers to sustain all species, e.g. food webs, food chains, mutualism.
- Internal and external factors that affect sustainability within a habitat, e.g. habitat and resource availability in an ecosystem, competition.
- Habitat and species management techniques to improve and sustain a range of habitats:
  - reintroduction, translocation, wildlife corridors for dispersal
  - afforestation, selective logging, fisheries (e.g. quotas, mesh size, closed seasons), education, eco-tourism, e.g. whale watching.
- Awareness of named current legislation regarding grasslands, forests, wetlands, coastal/aquatic environments.

Learning aim B: Understand human impacts on different environments

B1 Environmental impacts of agriculture and horticulture on ecosystems

- erection of glasshouses or polytunnels
- genetic engineering
- irrigation methods
- loss of habitat
- deforestation for agriculture and horticulture
- loss of habitat for crop production
- use of land for livestock production
- soil quality, e.g. depletion of soil nutrients, organic matter, erosion
- use of fertilisers and its effect on land and leaching into watercourse
- pest control.

B2 Other human impacts on the environment

- Extraction of natural resources, including rocks, minerals, sand, oil and natural gas.
- Renewable energy, including biofuel, solar, wind, tidal, hydroelectric dams.
- Tourism, including the aesthetics of a landscape, visitors, e.g. litter, soil erosion, buildings, effects on wildlife.
- Mitigation and restoration strategies.

Learning aim C: Examine influences and management strategies for weather hazards

C1 Weather hazards

Causes, features and impacts of major weather hazards.

- Tropical storms, hurricanes and cyclones.
- Flooding.
- Extreme drought.
- Extreme and prolonged cold temperatures.
- Extreme and prolonged hot temperatures.

C2 Managing the impact of weather hazards

Strategies for managing the impact of floods, fires, drought, high winds before and after the event.

- Early warning systems/weather monitoring.
- Emergency planning and preparation, e.g. flood defence systems, storage of rainwater, irrigation systems, fire breaks.
- Restoration and recovery.

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Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Explore the ecology and conservation of different environments</td><td rowspan="4">AB.D1 Discuss the factors affecting change, human impacts to ecosystems and techniques for managing biodiversity in a given context.</td></tr>
<tr><td>A.P1 Describe abiotic features, flora and fauna of a given ecosystem.
A.P2 Identify how changes in habitats can affect biodiversity and how this can be conserved in a given context.</td><td>A.M1 Explain how changes to the abiotic features, flora and fauna of ecosystems link to biodiversity and conservation management strategies in a given context.</td></tr>
<tr><td colspan="2">Learning aim B: Understand human impacts on different environments</td></tr>
<tr><td>B.P3 Describe human impacts and effects on the environment in a given context.</td><td>B.M2 Analyse the positive and negative human impacts on the environment in a given context.</td></tr>
<tr><td colspan="2">Learning aim C: Examine influences and management strategies for weather hazards</td><td rowspan="2">C.D2 Discuss strategies to manage a weather hazard.</td></tr>
<tr><td>C.P4 Identify the causes, features and impacts of a weather hazard.
C.P5 Outline a management strategy in response to a weather hazard.</td><td>C.M3 Explain the impacts and management of a weather hazard.</td></tr>
</table>

Essential information for assignments

This unit is assessed using a Pearson Set Assignment Brief. A set assignment must be used to assess learners.

Further information for teachers and assessors

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will demonstrate knowledge and understanding through their wider independent research and analysis of main features, the link between these and changes seen in different environments. Learners will demonstrate in-depth understanding of different conservation management techniques, their uses, advantages and disadvantages.

Learners will make reference to accurate land-based and environmental terminology throughout.

For Merit standard, learners will demonstrate knowledge through their research and explanation of the main features and changes seen in environments. Learners will outline in some depth different conservation management techniques and their purposes.

Learners will make reference to land-based and environmental terminology most of the time.

For Pass standard, learners will demonstrate knowledge by describing main features and changes seen in environments. Learners will describe the different conservation management techniques.

Learners will make some reference to land-based and environmental terminology.

Learning aim B

For Distinction standard, learners will demonstrate their knowledge and understanding through their wider independent research and review a range of techniques for managing habitats. They will outline techniques for improving sustainability and biodiversity in ecosystems.

Learners will use relevant and appropriate environmental terminology throughout.

For Merit standard, learners will demonstrate their knowledge and understanding, through their research, to analyse a range of techniques for managing habitats. Learners will also analyse techniques for improving sustainability and biodiversity in ecosystems.

Learners will use relevant and appropriate environmental terminology throughout.

For Pass standard, learners will demonstrate their knowledge by explaining a range of techniques for managing habitats. They will understand the techniques for improving sustainability and biodiversity in ecosystems.

Learners will use relevant and appropriate environmental terminology throughout.

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Learning aim C

For Distinction standard, learners will demonstrate understanding through discussion of the influences of weather hazards on the land and environment. Learners will discuss the growing issue of climate change, its links to increasing weather hazards and the impact this is having on the land and environment in the given context.

Learners will use appropriate scientific and environmental terminology throughout.

For Merit standard, learners will demonstrate their understanding by describing influences of weather hazards on the land and environment. Learners will explain climate change and its links to increasing weather hazards and the impact this is having on the land and environment in the given context.

Learners will use appropriate scientific and environmental terminology most of the time.

For Pass standard, learners will demonstrate their understanding by identifying the influences of weather hazards on the land and environment. Learners will provide partial information on climate change and its impact on the land and environment in the given context.

Learners will use some appropriate scientific and environmental terminology.

Assessment controls

Time: this assignment has a recommended time period. This is for advice only and can be adjusted depending on the needs of learners.

Supervision: you should be confident of the authenticity of learner's work. This may mean that learners be supervised.

Resources: all learners should have access to the same types of resources to complete the assignment.

Research: learners should be given the opportunity to carry out research outside of the learning context if required for the assignment.

Links to other units

This is an underpinning unit for the qualification.

Opportunities to develop transferable employability skills

Learners will have opportunities to develop the following transferable skills in the assessment of this unit:

- research skills
- presentation skills
- written and verbal communication skills.

Unit 4: Developing a Land-based Enterprise

Level: **3**
Unit type: **Internal set assignment**
Guided learning hours: **60**

Unit in brief

Learners develop skills that allow them to plan for a start-up business. They will evaluate research and financial feasibility.

Unit introduction

Understanding the operation of any business is vital if it is to be successful. This includes knowledge and understanding of the business environment, marketplace and business management skills. The land-based sector is predominately made up of small- and medium-sized businesses, and this provides many opportunities to set up your own business.

In this unit, you will learn about the resources and processes that businesses operating in the land-based sector need, these include human, physical and financial features. You will undertake a financial viability study, preparing cash flows, an income statement and a statement of financial position. You will carry out market research in order to identify a viable enterprise, leading to the production and presentation of a viable business start-up plan for a chosen land-based enterprise.

These activities will prepare you for employment in the land-based sector in a role such as unit manager, and for self-employment in the sector. This unit also enables you to progress to a higher-education course such as a degree in land-based business management or a relevant vocational degree, for example horticulture and countryside management.

Assessment

This unit has Pearson Set Assignment. Learners must complete a Pearson Set Assignment Brief.

Learning aims

In this unit you will:

A Explore features, processes and resource requirements of land-based businesses

B Investigate the viability of land-based enterprises

C Carry out business start-up planning for a land-based enterprise.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore features, processes and resource requirements of land-based businesses	**A1** Features of land-based businesses **A2** Resource requirements of land-based businesses **A3** Land-based business processes and procedures	This unit is assessed through a Pearson Set Assignment.
B Investigate the viability of land-based enterprises	**B1** Market research and analysis **B2** Financial feasibility of a land-based enterprise	
C Carry out business start-up planning for a land-based enterprise	**C1** Features of a business start-up plan **C2** Presenting the business plan	

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Content

Learning aim A: Explore features, processes and resource requirements of land-based businesses

A1 Features of land-based businesses

- Ownership and liability, to include sole trader, partnership, private and public limited company, franchises, public sector businesses, not-for-profit.
- Objectives associated with business type, e.g. supply of products or services, not-for-profit, profit making.
- Scope of business activities, to include local, national, international.
- Link between land-based and associated industries in the supply chain, e.g. production and manufacturing, leisure and tourism.
- Reasons for success and how they differ depending on ability to meet demand, use of technology, type of business, innovative products or systems.
- Importance of land-based industries to regional and local economies, including social and environmental impact, e.g. bringing employment, gross domestic product (GDP), changes in biodiversity, sustainability.

A2 Resource requirements of land-based businesses

- Physical resources, to include land, machinery, equipment, materials.
- Human resources, including skills and knowledge requirements, staff, structure.
- Financial resources, including internal (retained profit) and external sources (loans, hire purchase, grants).
- Educational resources, such as professional trade associations and trade bodies, government organisations, e.g. environment agencies, food agencies, research organisations.

A3 Land-based business processes and procedures

Importance, legal aspects and management efficiency.

- Sourcing materials and services, e.g. timing, purchasing, ordering procedures, credit control, record keeping.
- Planning the production of products or services, e.g. forecasting supply and demand, methods of production (job, batch, lean, flow).
- Sales and marketing, e.g. pricing strategies, costs, internal and external communication, promotional activities (direct marketing, advertising).
- Legislative recording requirements, e.g. health and safety, use of chemicals, food safety, plant and animal passports.
- Details and purpose of relevant registration schemes, e.g. farm assurance schemes, quality management schemes, land registry, forest stewardship.
- Monitoring business operations to improve performance, e.g. gross margin, production levels, financial efficiency, against targets, advantages, disadvantages.

Learning aim B: Investigate the viability of land-based enterprises

B1 Market research and analysis

Understanding the marketplace, customers and competitors.

- Target market, e.g. types of customer, age, location.
- Primary and secondary research, e.g. questionnaires, surveys, interviews.
- Analysis of the business environment, including Porter's five forces, PESTLE (political, economic, social, technological, legal, environmental) and SWOT (strengths, weaknesses, opportunities, threats).
- Competitor analysis, to include indirect and direct competitors, local, national, international, market share, reputation, pricing, customers.
- Barriers to setting up, e.g. viability, cash flow, finance, legislation, resources.

B2 Financial feasibility of a land-based enterprise

Financial feasibility study – assessment of financial aspects of starting up an enterprise.

- Amount of finance needed, including set-up costs, fixed and variable costs.
- Sources of capital, e.g. investors, own, grants, loans.
- Financial accounts and records, to include:
  - income statement
  - statements of financial position
  - cash flow forecasts
  - break-even forecast
  - net profit margins.

Learning aim C: Carry out business start-up planning for a land-based enterprise

C1 Features of a business start-up plan

Key areas that need to be included in a business plan.

- Purpose of the enterprise, e.g. sales, service.
- Business aims and objectives, e.g. profit, survival, growth, long- and short term.
- Legal structure and operation.
- Resource requirements.
- Promotion, including methods and costs.
- Financial forecasts, including opening and closing statement of financial position, capital to show investment needed, cash flow forecast.
- Summary of market analysis and competition.
- Measures of success, e.g. financial and non-financial key performance indicators.
- Risks and contingency plans.

C2 Presenting the business plan

- Documentation, to include financial forecasts, summary of business, business plan.
- Methods of presenting the business plan to potential investors, e.g. stakeholders, bank, formal, informal, face to face, via submission of documentation.
- Purposes, e.g. to gain investors, enable potential investor or stakeholder to make decisions based on the information.
- Strengths and weaknesses of planning, research and implementation and areas for improvement, e.g. self-reflection, sufficient time and depth of research.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Explore features, processes and resource requirements of land-based businesses</td><td rowspan="3">AB.D1 Evaluate the viability of land-based enterprises, taking into account key business features, requirements, processes and financial information.</td></tr>
<tr><td>A.P1 Explain the features and requirements of a land-based business.
A.P2 Explain the processes involved in the operation of a land-based business.</td><td>A.M1 Analyse the impact of business features, resource requirements and processes on the operation of a land-based business.</td></tr>
<tr><td colspan="2">Learning aim B: Investigate the viability of land-based enterprises</td></tr>
<tr><td>B.P3 Explain factors affecting the viability of a land-based enterprise.
B.P4 Perform basic financial calculations.</td><td>B.M2 Analyse the viability of a land-based enterprise using financial calculations effectively.</td><td></td></tr>
<tr><td colspan="2">Learning aim C: Carry out business start-up planning for a land-based enterprise</td><td rowspan="2">C.D2 Perform comprehensive business planning with professional communication for a selected land-based enterprise.</td></tr>
<tr><td>C.P5 Perform business start-up planning for a selected land-based enterprise.
C.P6 Communicate business start-up planning appropriately.</td><td>C.M3 Perform detailed business planning with effective communication for a selected land-based enterprise.</td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, AB.D1)

Learning aim: C (C.P5, C.P6, C.M3, C.D2)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a land-based business that will allow learners to gain information about the organisation and processes
- business planning tools or information/support such as that provided by banks etc.

Essential information for assessment decisions

Learning aims A and B

For Distinction standard, learners will show depth of understanding by making links between key business features, resources, processes and procedures, and how they may impact on the performance of an enterprise operating in the land-based sector. Learners will produce a robust introductory report that fully explores the viability of the potential enterprise options with which they are presented, giving a well-developed and balanced account of the available information. They will demonstrate coherent reasoning throughout, with confident and accurate use of appropriate financial calculations and forecasts to support their arguments, and show depth and breadth of understanding through their consideration of any further research that may be needed to fully assess the potential success of the enterprise options.

For Merit standard, learners will make a number of links between key business features, resources, processes and procedures, and how they may impact on the success of an enterprise operating in the land-based sector. Learners will produce a logical introductory report that explores the viability of the potential enterprise options with which they are presented, making analytical judgements of the available information. They will demonstrate logical reasoning throughout, using appropriate and accurate financial calculations and forecasts to support their arguments. They will consider the limitations of the information provided to them, identifying how this impacts on their decision making and suggesting further areas that may need to be addressed to assess the potential success of the enterprise options.

For Pass standard, learners will consider the key business features, resources, processes and procedures that may impact on the success of an enterprise operating in the land-based sector. Learners will produce a report that shows investigation of the viability of each of the potential enterprise options with which they are presented. They will use some appropriate and accurate financial calculations and forecasts in arriving at the enterprise option they consider most viable. They will make some reference to the limitations of the information available and how this may affect the success of the enterprise options.

Learning aim C

Learners will prepare a business plan for the development of a land-based enterprise. Presentation of the business plan can take the form of a formal presentation, an informal meeting or discussion or submission of the written documentation, as appropriate.

For Distinction standard, learners will prepare a comprehensive preliminary business plan for an enterprise, confidently presenting aspects of physical and human resource requirements for both the short- and long term, and considering methods that could be used in marketing and research. They will explore the potential benefits and risks that may arise in detail, providing realistic projections. They will present the business plan in a professional manner, with consistent and fluent use of technical language.

For Merit standard, learners will prepare a detailed business plan for an enterprise that presents an analysis of resource and financial needs. They will provide a valid justification of physical and human resources, supported by the effective use of calculations and forecasts. They will make reference to marketing and research requirements. They will present the business plan in a logical and coherent manner, with use of technical language throughout.

For Pass standard, learners will prepare a basic business plan for an enterprise that outlines the physical and human resources required and which demonstrates application of appropriate calculations and forecasts. The business plan will be presented in an appropriate manner with some use of appropriate technical language.

Assessment controls

Time: this assignment has a recommended time period. This is for advice only and can be adjusted depending on the needs of learners.

Supervision: you should be confident of the authenticity of learner's work. This may mean that learners be supervised.

Resources: all learners should have access to the same types of resources to complete the assignment.

Research: learners should be given the opportunity to carry out research outside of the learning context if required for the assignment.

Links to other units

This unit links to *Unit 7: Work Experience in the Land-based Sectors*.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses from industry
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills
- presentation and formal written communication skills
- time management and scheduling skills.

Unit 5: Operational and Environmental Activities in Land-based Enterprises

Level: **3**
Unit type: **Internal set assignment**
Guided learning hours: **60**

Unit in brief

Learners study the knowledge and skills required to manage day-to-day operational and environmental activities in a land-based enterprise.

Unit introduction

Understanding the routine operational requirements and environmental impact of land-based practices is a vital component of being able to manage a land-based enterprise.

In this unit, you will study how and why different land-based practices have changed over time, along with the environmental impact of land-based practices. You will explore the working environment of land-based enterprises, including regular operational activities, requirements and challenges. You will investigate the methods used to manage the impact of land-based practices on the environment and ways of managing the operational and environmental activities of a land-based enterprise.

You will learn how to plan for and review the success of the processes and activities involved in managing a land-based enterprise, using this as a basis to prepare recommendations for possible improvements.

This unit will prepare you for employment and self-employment in the land-based sector. It will also assist you in progression to higher-education courses such as degrees in agriculture, horticulture or land-based business management.

Assessment

This unit has a Pearson Set Assignment. Learners must complete a Pearson Set Assignment Brief.

Learning aims

In this unit you will:

A Explore the impact of land-based practices on local environments

B Explore operational and environmental management activities for land-based enterprises

C Plan operational and environmental management activities for land-based enterprises.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore the impact of land-based practices on local environments	**A1** Changes in land-based practices **A2** Environmental impact of land-based practices	This unit is assessed through a Pearson Set Assignment.
B Explore operational and environmental management activities for land-based enterprises	**B1** Working environment of a land-based enterprise **B2** Environmental management activities **B3** Managing operational and environmental activities	
C Plan operational and environmental management activities for land-based enterprises	**C1** Planning processes for operational management activities **C2** Planning processes for environmental management activities **C3** Evaluating management performance	

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Content

Learning aim A: Explore the impact of land-based practices on local environments

A1 Changes in land-based practices

- Interrelationships between farming practices and the environment, e.g. monoculture, water use and storage, whole farm management, food safety and animal welfare, waste management, land use.
- Economic and environmental value of habitat sites on farms, e.g. biodiversity, advantages such as cost saving, local community involvement, waste control.
- Changes in land-based practices, e.g. technology, mechanisation, increasing yield and outputs, consumer pressures, farming for energy, sustainable farming, legislation.

A2 Environmental impact of land-based practices

- Environmental impact of land-based practices, including climate change, energy use, deforestation, genetic engineering, water challenges, pollutants, soil degradation and waste.
- Positive environmental impacts: e.g. use of cover crops, conservation, reusing waste, carbon storage.
- Negative environmental impacts, e.g. habitat loss, soil erosion, water loss and eutrophication.
- Government and non-government organisations involved in environmental issues.
- Current relevant regional and international legislation and codes of practice.

Learning aim B: Explore operational and environmental management activities for land-based enterprises

B1 Working environment of a land-based enterprise

- Purpose and objectives of the enterprise, e.g. breeding stock, milk and meat production, potatoes for processing, grain for storage or milling, production of plants and crops.
- Regular operations of a land-based enterprise, e.g. daily, weekly, monthly operations.
- Recording requirements for income and expenditure, e.g. staff and machinery costs, stock and seed purchases, sales of stock, milk, grain or other produce, other income sources.
- Where and when to seek specialist help, e.g. vets, agronomists, experts in pests and diseases, government departments, machinery dealers, farmers' unions, health and safety organisations, industry associations, local support groups.
- Security processes and procedures for the operation of an enterprise, including machinery, grain stores, silos, lone working, biosecurity for livestock, plants and soil.
- Challenges associated with the operation of a land-based enterprise, e.g. people, technology, land use and sustainability.

B2 Environmental management activities

- Surveying of environment, e.g. biodiversity, key species, waterways, soil health and fertility.
- Monitoring and controlling use of resources including water, energy.
- Strategies, e.g. grazing management, irrigation, increasing biodiversity, managing by-products and pollution sources.
- Assessing need for chemical use, advantages and disadvantages of application methods, e.g. pesticides, herbicides, fertilisers.

B3 Managing operational and environmental activities

- Communicating the daily or weekly activities to others, including routine activities, health and safety procedures, emergency procedures, report for unit/farm manager.
- Ensuring the work is advancing according to expectations, including compliance with the activities plan, regulations and codes of practice, managing risks, monitoring progress and quality of work.
- Using problem-solving skills to assess issues, examine alternatives, decide on a course of action, implement solutions and monitor outcomes.
- Emergencies, incidents and accidents, e.g. dissemination of information in case of local or national disease outbreaks and threats, dealing with immediate health or environmental issues, e.g. how to call for assistance, information required by emergency services to be able to locate and assist.

Learning aim C: Plan operational and environmental management activities for land-based enterprises

C1 Planning processes for operational management activities

- Planning cycle for a land-based enterprise, e.g. aims of the enterprise, preparing and monitoring plans, evaluation.
- Processes to aid planning of operations, including budgets, work schedules and flow charts.
- Planning tasks for regular activities to meet seasonal variations, e.g. scheduling of activities, equipment, materials, costs, considerations of health and safety.
- Resourcing to meet planned operations, including machinery, materials and additional skills, e.g. internal workforce, external contractors, seasonal staff.
- Communicating with others to ensure efficient planning, e.g. staff, machinery contractors, plant and livestock health specialists.
- Assessing hazards and risk, relevant health and safety considerations, including use of personal protective equipment (PPE), safe lifting, animal welfare, safe use of chemicals, emergency procedures.
- Contingency planning, e.g. setting and adjusting priorities, making decisions, reporting changes.

C2 Planning processes for environmental management activities

- Task allocation and schedules, taking into account the local environment, facilities, sources of expertise, seasonality, objectives of plan.
- Tools, materials and equipment for practical tasks, including suitable general tools and species-specific tools.
- Use of maps providing visual plan of the site, e.g. soil types, boundaries, roads, vegetation, utilities.
- Assessing hazards and risk, relevant health and safety considerations, including compliance with regional and international legislation and codes of practice, site restrictions or designations.

C3 Evaluating management performance

- Collecting feedback, e.g. from colleagues, farm/unit manager, experts.
- Reviewing feedback and drawing conclusions against the plan, including:
  - extent to which the aims of activities are met
  - SWOT (strengths, weaknesses, opportunities, threats) analysis
  - workability of contingency plans
  - suggesting improvements and further development.
- Creating an evaluation framework to assess:
  - effectiveness of processes against given criteria, e.g. aims, objectives
  - management performance, including communication of work instructions, problem solving, dealing with contingencies, cooperation with others.
- Evaluating processes and performance against task completion and evaluation framework.
- Identifying areas for improvement in management processes, e.g. systems, efficiencies, skills, training, timescales
  - action plans to highlight how to address weaknesses and skills development
  - use of feedback from relevant sources, e.g. peer observation, videos, teacher observation or witness sheets
  - suggestions on how weaknesses could be addressed.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Explore the impact of land-based practices on local environments</td><td rowspan="3">AB.D1 Evaluate relationships between land-based practices, the working environment, routine activities and management skills on the environmental impact and operation of a land-based enterprise.</td></tr>
<tr><td>A.P1 Explain changes in land-based practices.
A.P2 Explain the environmental impact of land-based practices.</td><td>A.M1 Analyse positive and negative impacts of land-based practices and the approaches used on habitats and the environment.</td></tr>
<tr><td colspan="2">Learning aim B: Explore operational and environmental management activities for land-based enterprises</td></tr>
<tr><td>B.P3 Explain the working environment and routine activities of a land-based enterprise.
B.P4 Explain environmental management activities for a land-based enterprise.</td><td>B.M2 Analyse the importance of the working environment, routine activities and skills required for managing the environment and operation of a land-based enterprise.</td></tr>
<tr><td colspan="2">Learning aim C: Plan operational and environmental management activities for land-based enterprises</td><td rowspan="2">C.D2 Undertake comprehensive planning with detailed rationale for managing the environmental impact and operational activities of a land-based enterprise.</td></tr>
<tr><td>C.P5 Undertake planning with simple rationale for managing operational and environmental activities for a land-based enterprise.</td><td>C.M3 Undertake detailed planning with rationale for managing operational and environmental activities for a land-based enterprise.</td></tr>
</table>

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Essential information for assignments

This unit is assessed using a Pearson Set Assignment Brief. A set assignment must be used to assess learners.

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a land-based enterprise (which could be the college farm or a local employer who works with the college) to provide relevant, up-to-date facilities
- land-based habitats and a suitable range of equipment to carry out practical surveying
- input from those working for a land-based enterprise or a related field, such as a farm or unit manager, service engineer, environmental manager.

Essential information for assessment decisions

Learning aims A and B

For Distinction standard, learners will demonstrate comprehensive investigation of the routine activities and operation of a land-based enterprise to show a complete understanding of the working environment and the impact of land-based practices on the environment.

Learners will use well-selected, robust and valid examples from their research when reviewing land-based practices within a given context. They will consistently select, apply and synthesise accurate knowledge and understanding of all the key aspects of the land-based enterprise to support the points they make.

Learners will show clear understanding of good practice in environmental management. They will consistently demonstrate accurate selection and application of knowledge and skills relating to professional working responsibilities, legislation, and safe working practices.

Learners will provide consistently well-reasoned and valid judgements that link logically and specifically to their views. They will justify their conclusions by making specific, clear links regarding the relationship between the enterprise operation and the skills required for effective management.

Learners will use appropriate, accurate land-based terminology throughout.

For Merit standard, learners will demonstrate investigation of the routine activities and operation of a land-based enterprise and the environmental impact of land-based practices.

Learners will use relevant examples from their research, using these to support their analysis of positive and negative impacts of land-based practices within a given context. They will select and apply relevant knowledge and skills to give a clear, balanced analysis of the key aspects of the land-based enterprise.

Learners will make reasoned, analytical judgements regarding the relationship between the enterprise operation and the skills required for managing the environment and operations.

Learners will use appropriate land-based terminology throughout.

For Pass standard, learners will show they have researched the operation and routine activities of a land-based enterprise and the impact of land-based practices on the environment, which may be generalised or superficial in some places.

Learners will use some examples from their research to give an account of the changes in land-based practices within a given context, demonstrating awareness of how these changes have come about, for example, through the influence of legislation, relevant organisations and improvements in efficiency. They will make links between land-based practices, their impact on the environment and how this can be managed, for example, fertiliser use and effect on waterways. However, these might be limited in scope or depth.

Learners will demonstrate knowledge and some understanding of the structure of a land-based enterprise, making rational links to the operation and routine activities of the enterprise and applying basic knowledge of professional responsibilities, legislation and working safely.

Learners will use some appropriate technical language.

Learning aim C

For Distinction standard, learners will produce a well-considered and convincing management plan for the environmental and operational activities of a given context. They will show that they have considered how their plans would be implemented in terms of, for example, resources, maintaining records, identifying the impact of delays, health, safety and legislative implications.

Learners will use logical, professional arguments that are well substantiated when outlining their approaches to environmental and operational management strategies. They will reference the importance of data and research in the development of their plan and to support any recommendations they make.

They will demonstrate good understanding of how to review the effectiveness of their plan using a clear, valid evaluation framework and making links to measurable outcomes.

Learners will use appropriate, accurate land-based terminology throughout.

For Merit standard, learners will produce a management plan for the environmental and operational activities of a given context, showing relevant and logical consideration of the resources required for operational and environmental activities, for example, dealing with staff or contractors, maintaining records and managing resources.

Learners will provide justification for their plan that demonstrates their selection and application of relevant knowledge and understanding, including health, safety and legislative requirements.

Learners will demonstrate clear understanding of how to review the effectiveness of their plan using an evaluation framework to assess management processes and activities.

Learners will use appropriate land-based terminology throughout.

For Pass standard, learners will produce a management plan for the environmental and operational activities of a given context which is realistic but may be limited. They will outline tasks that would need to be undertaken, demonstrating some relevant, competent planning skills and awareness of safe working practices.

Learners will give relevant but limited explanations for their planning decisions that demonstrate knowledge of resource management, safe working and compliance with legislation.

Learners will demonstrate an understanding of how the effectiveness of the plan can be assessed using a simple evaluation framework.

Learners will use some appropriate technical language.

Assessment controls

Time: this assignment has a recommended time period. This is for advice only and can be adjusted depending on the needs of learners.

Supervision: you should be confident of the authenticity of learner's work. This may mean that learners be supervised.

Resources: all learners should have access to the same types of resources to complete the assignment.

Research: learners should be given the opportunity to carry out research outside of the learning context if required for the assignment.

Links to other units

This unit links to:

- Unit 4: Developing a Land-based Enterprise
- Unit 6: Land-based Business Improvements
- Unit 10: Farm Livestock Husbandry
- Unit 17: Crop Production.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to teaching and learning materials
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- review and evaluation skills of their development of plans and their performance in a wider team when undertaking practical activities
- independent tracking and monitoring of project work as it develops
- learners will be able to reflect on their individual skills and weaknesses when completing land-based processes or operations. Learners will then be able to improve their personal performance and set targets to focus on these improvements in the future.

Unit 6: Land-based Business Improvements

Level: **3**
Unit type: **Internal set assignment**
Guided learning hours: **60**

Unit in brief

Learners will develop the skills and knowledge needed to be able to examine the impact that the environment has on the way that land-based businesses operate. Learners will then be able to identify and plan opportunities for improvement or diversification.

Unit introduction

The successful operation of land-based businesses requires staff to have insight into the business environment and the marketplace in which these businesses operate. Internal and external pressures on land-based industries and the businesses that operate in the sector have increased and changed in recent years. This means that in order to remain viable many land-based businesses must consider ways of improving or diversifying their operations.

In this unit, you will learn about the features of land-based businesses, their scope and importance, and the markets in which they operate. You will investigate the external and internal influences that have an impact on the performance of a land-based business, including customer trends, changes in legislation and local and global responses. You will carry out a review of a business's performance to identify and recommend changes or alternatives to its current operations to improve performance.

This unit will prepare you for employment in the land-based sector in a variety of roles and will also prepare you for self-employment in the sector. The unit will enable you to progress to a higher-education course such as a degree in land-based business management.

Assessment availability

This unit has a Pearson Set Assignment. Learners must complete a Pearson Set Assignment.

Learning aims

In this unit you will:

A Explore the land-based business environment to identify opportunities for improvements

B Examine the influences on land-based business performance

C Plan opportunities for improvement in a land-based business.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore the land-based business environment to identify opportunities for improvements	**A1** The scope and importance of land-based businesses **A2** Land-based business operations **A3** The land-based business marketplace	This unit is assessed through a Pearson Set Assignment.
B Examine the influences on land-based business performance	**B1** Product trends and consumer trends **B2** Other influences impacting on land-based business performance **B3** Benefits and risks associated with growing a land-based business	
C Plan opportunities for improvement in a land-based business	**C1** Improving land-based business performance **C2** Planning land-based business improvements	

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Content

Learning aim A: Explore the land-based business environment to identify opportunities for improvements

A1 The scope and importance of land-based businesses

- Range of organisations and their purpose, e.g. commercial, not-for-profit, regulatory.
- Importance of land-based industries to regional and local economies, including social and environmental impact, e.g. bringing employment, contribution to GDP, changes in biodiversity, sustainability.
- Associated industries, e.g. relevant industries in primary, secondary and tertiary sectors.
- Associated organisations in the land-based sector, including:
  - aims and objectives of key organisations
  - suppliers of goods and services, e.g. animal or crop advisers, machinery suppliers
  - regulatory bodies.

A2 Land-based business operations

- Business types, e.g. mixed farms, arable, livestock, fruit, vegetables.
- Aims and objectives of businesses, including mission, vision and purpose, e.g. breeding stock, milk production, potatoes, cereals.
- Role and importance of key operational records (monitoring, performance targets, benchmarks, legislation).
- Interpretation of graphs/charts/tables of performance measures.
- Calculation of percentage increases and decreases in performance measures.
- Financial forecasts, including opening and closing statement of financial position, capital to show investment needed, cash flow forecast, fixed and variable costs, break-even point.
- Organisational structure, including hierarchical, flat, matrix.

A3 The land-based business marketplace

- Marketplace, customers and competitors, including size of market (local, national, international), customer characteristics and trends, direct and indirect competition, competitor analysis, import or export tariffs.
- Stakeholders:
  - internal, e.g. managers, employees, owners
  - external, e.g. customers, debtors, creditors, representative organisations
  - communities (local, national, international).
- Importance of efficiency and interdependency in the supply chain, e.g. suppliers, distributors, processors, intermediaries, customers, choosing suppliers, ensuring supply and demand, supply chain assurance.
- Quality management systems and practices, including important aspects of quality in land-based businesses, formal quality standards or schemes and approval, role of quality-assurance schemes, farming systems and practices to achieve quality, problems if quality is not achieved.

Learning aim B: Examine the influences on land-based business performance

B1 Product trends and consumer trends

Influences that could have a potential impact on a business as it considers opportunities for development.

- Changing customer preferences, e.g. health, cost, local produce, sustainable products, traceability.
- Changing demographics, e.g. increasing and older population, cultural changes.
- Evolving technologies and technological developments, e.g. improved transport and technological links, sustainable options, changes to traditional seasonal availability of products.

B2 Other influences impacting on land-based business performance

- PESTLE analysis (political, economic, social, technological, legal and environmental):
  - political and economic stability
  - differing standards of living and wage costs
  - technological advances and increasing reliance on technology for business operations, processes and transactions
  - laws/legislation
  - weather extremes.
- Regional influences on business:
  - potential positive and negative impacts of migration.
- Internal factors impacting on business performance:
  - staff, including skills, availability, training, cost
  - finance and capital, e.g. cash flow, loans
  - use of financial and physical records, e.g. interpreting information on production levels, costs, financial efficiency, break-even, gross margins, losses
  - land and security of tenure
  - equipment and machinery.

B3 Benefits and risks associated with growing a land-based business

- Business growth, consolidation, improvements, diversification and expansion, advantages and disadvantages.
- Support mechanisms, e.g. organisations, education providers, local network or discussion groups.
- New market developments, e.g. niche products, unique selling points, specialist products, leisure services and customer experience.
- Recognition and reputation, e.g. quality-assurance schemes customer feedback, sector awards.
- Risks, including failure to meet customer needs, buyer requirements, return on investment, risk of losing business.
- Potential impact of improved or weakened business performance on the financial and physical resources of the business, e.g. impact on product quality, trading arrangements, staff, equipment and machinery.

Learning aim C: Plan opportunities for improvements in a land-based business

C1 Improving land-based business performance

- A business plan as a tool to improve a business's performance.
- Strategies, including consolidation, diversification, expanding market share, product development, market development, co-operatives, continuous improvement.
- SWOT analysis (strengths, weaknesses, opportunities, threats).
- Key indicators of improved performance:
  - improved effectiveness and efficiency in key functional areas, e.g. production, working practices, financial control
  - competitive advantage, e.g. quality, price, location
  - additional funding sources, e.g. to support business expansion, grants, overdrafts, loans, locally based initiatives.
- Contingency planning and external agencies, e.g. risk analysis, role of consultants, advice and guidance, alternative options available to businesses, use of benchmarking data.

C2 Planning land-based business improvements

- Plan, to include opportunities, specific actions, rationale, timescales, resource implications, financial implications and risks.
- Key indicators of success and risks, e.g. efficiency and improvements in production, working practices, financial.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Explore the land-based business environment to identify opportunities for improvements</td><td rowspan="4">AB.D1 Comprehensively review the performance of a land-based business, including the influences impacting on operations.</td></tr>
<tr><td>A.P1 Explain the relationship between the operation of a land-based business and the marketplace in which it operates.</td><td>A.M1 Analyse the importance of the business environment, marketplace and operations when identifying opportunities for improvements.</td></tr>
<tr><td colspan="2">Learning aim B: Examine the influences on land-based business performance</td></tr>
<tr><td>B.P2 Explain the influences impacting on the performance of a land-based business.
B.P3 Review the performance of a land-based business.</td><td>B.M2 Analyse the influences impacting on the performance of a land-based business.
B.M3 Review, in detail, the performance of a land-based business.</td></tr>
<tr><td colspan="2">Learning aim C: Plan opportunities for improvements in a land-based business</td><td rowspan="2">C.D2 Comprehensively plan improvements for a land-based business, justifying recommendations.</td></tr>
<tr><td>C.P4 Explain the strategies used to improve business performance.
C.P5 Plan business improvements for a land-based business.</td><td>C.M4 Plan detailed business improvements for a land-based business, making recommendations for improvement.</td></tr>
</table>

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Essential information for assignments

This unit is assessed using a Pearson Set Assignment Brief. A set assignment must be used to assess learners.

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- an agricultural crop or livestock business such as the college farm, a local agricultural employer or a work experience farm
- input from those currently working in a land-based business or a related field in the land-based sector, such as a farm manager or a unit manager.

Essential information for assessment decisions

Learning aims A and B

For Distinction standard, learners will review a land-based business in the given context using stimulus material provided. This will consider the internal and external influences affecting business performance. Learners will be able to determine the overall success of a land-based business. They will demonstrate depth and breadth of knowledge and understanding by making justified links between a land-based business, the marketplace and its operation. Learners will identify opportunities for improvement or development and discuss how these could be achieved.

Learners will interpret contextualised data, using this as a tool to measure and monitor business performance. They will use appropriate land-based and business terminology throughout.

For Merit standard, learners will analyse a land-based business in the given context using a range of stimulus material. They will demonstrate knowledge and understanding by making connections between a land-based business, the marketplace and its operation. Learners will be able to discuss influences on the business and its success and identify areas for improvement and development.

Learners will interpret some data in order to measure business performance. They will use some land-based and business terminology throughout.

For Pass standard, learners will consider a land-based business in the given context using stimulus material. They will show understanding by explaining the relationship between a land-based business, the marketplace and its operation. Learners will be able to identify influences on the business and its success and suggest improvements and potential development.

Learners will interpret some data and link this to business performance. They will use some land-based and business terminology throughout.

Learning aim C

For Distinction standard, learners will demonstrate their understanding by presenting a comprehensive plan for improvement of a land-based business. They will demonstrate knowledge of a range of strategies that can be used to improve the performance of a land-based business.

Learners will give a clear and detailed recommendations for improvement with thorough and well considered justifications.

Learners will use accurate and appropriate land-based and business terminology throughout.

For Merit standard, learners will produce a plan for improvement of a land-based business. They will demonstrate an understanding of how to improve the performance of a land-based business.

Learners will be able to give recommendations for improvement of business performance with some justifications.

Learners will use accurate and appropriate land-based and business terminology throughout.

For Pass standard, learners will explain strategies and be able to plan for improvement of a land-based business together with an understanding of how to improve business performance.

Learners will use some appropriate land-based and business terminology throughout.

Assessment controls

Time: this assignment has a recommended time period. This is for advice only and can be adjusted depending on the needs of learners.

Supervision: you should be confident of the authenticity of learner's work. This may mean that learners be supervised.

Resources: all learners should have access to the same types of resources to complete the assignment.

Research: learners should be given the opportunity to carry out research outside of the learning context if required for the assignment.

Links to other units

This unit links to:

- Unit 2: Estate Skills
- Unit 7: Work Experience in the Land-based Sectors.

Unit 7: Work Experience in the Land-based Sectors

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners research work opportunities in the land-based sectors and the skills needed to attain them, developing communication and employability skills through study and work experience.

Unit introduction

Where do you picture yourself in five years' time? Do you know about the wide range of career opportunities open to you in the land-based sectors? Discovering these opportunities and understanding the skills and qualifications needed in order to gain employment in these sectors will help you to answer these questions as well as to plan your career.

In this unit, as well as investigating employment opportunities, you will examine how good communication and employability skills can improve your prospects in gaining and staying in employment. You will learn how and where to access information about employment vacancies and further courses of study as well as how to develop your curriculum vitae (CV) and adapt it for specific vacancies. You will also learn how to develop good communication, interview and customer service skills. You will apply for and take on available work experience roles in the sector and reflect on your own progress.

This unit will help prepare you for employment in the land-based sectors in areas such as forestry, arboriculture, aquaculture, landscaping, horticulture, fencing, fisheries management, floristry, gamekeeping, conservation, countryside management and wildlife management, and their related service industries. It will also help you progress to higher education in courses such as BSc (Hons) degrees in agriculture, countryside management, horticulture and forestry management.

Learning aims

In this unit you will:

A Investigate land-based employment opportunities to target progression

B Develop communication and interview skills to improve employment prospects in the land-based sector

C Undertake work experience in the land-based sector to contribute to personal and professional development.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate land-based employment opportunities to target progression	**A1** Scope of the land-based sectors **A2** Requirements for progression **A3** Relevant legislation for work placement opportunities	A portfolio of work-related learning research, completed application documents and mock interview outcomes, e.g. observation, video.
B Develop communication and interview skills to improve employment prospects in the land-based sector	**B1** Applying for work-related activities **B2** Interview skills **B3** Reflecting on preparation and performance	
C Undertake work experience in the land-based sector to contribute to personal and professional development	**C1** Practical work experience **C2** Work behaviours **C3** Reflecting on workplace practice	A report reflecting on work experience, informed by employer verification of participation and other feedback.

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Content

Learning aim A: Investigate land-based employment opportunities to target progression

A1 Scope of the land-based sectors

- Analysis of progression opportunities to determine desirability, suitability and feasibility.
- Land-based sectors – appropriate broad representation of current industries, e.g. production crops, agricultural livestock, aquaculture, environmental conservation, countryside management, fencing, fisheries management, floristry, gamekeeping and wildlife management, land-based engineering, landscaping, production and amenity horticulture, forestry and arboriculture.
- Opportunities – the range of career and progression opportunities available within chosen sector and opportunities within related sectors, e.g. retail, leisure, tourism, hospitality.
- Higher education – UCAS, entry requirements, student loans.
- Apprenticeships – requirements, timescales, pay scales, balance between academic and practical work, assessment, higher apprenticeships.
- Employment sectors:
  - public sector, e.g. education, government, local government, countryside officer/ranger, public grounds and parks
  - private sector, e.g. country parks, garden centres
  - voluntary sector or charities, e.g. wildlife trusts, wildlife parks.
- Employment sectors, to include an appropriate broad representation of current industries, e.g. agricultural sales, food production, aquaculture, floristry, production horticulture, land-based engineering.
- Self-employment, e.g. gamekeeper, agricultural contractor, arborist, gardener.

A2 Requirements for progression

Knowledge of formal and informal requirements for progression.

- Entry criteria, including qualifications, skills and knowledge.
- Self-management, including study skills, presentation and attitude, time management and planning.
- Exit criteria for specific progression routes.
- Soft skills, including communication, problem solving, individual and team and leadership skills, personal management.

A3 Relevant legislation for work placement opportunities

- Safeguarding at work placements.
- Contracts of employment and working hours (in relation to age), including zero-hours contracts/fixed-term/hourly paid/permanent (full-/part-time) contracts, Working Time Regulations 1998, Pay As You Earn (PAYE), statutory leave, maternity/paternity leave, employment status.
- Different legal status of business: single owner (self-employed)/partnership/limited company/self-employed subcontractor.

- Awareness of the impact of current legislation supporting conduct in the workplace for employers and employees (full-time, part-time, casual, interns and work placements), such as:
  - health and safety at work legislation
  - equality legislation
  - data protection legislation
  - Control Of Substances Hazardous to Health (COSHH) regulations
  - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)
  - animal welfare legislation.

Learning aim B: Develop communication and interview skills to improve employment prospects in the land-based sector

B1 Applying for work-related activities

- Selection of work, including different sources of vacancies such as websites, trade publications and sector-wide bodies, e.g. Lantra.
- Importance of reading job description, personal specification, including relevance of essential or desirable criteria, to include qualifications, skills, experience.
- Completion of CV and adapting CV or job application to specified vacancy.
- Letters of application, supporting statements and completing application forms, to include standing out from the crowd, addressing relevance to employers and how they might shortlist candidates.
- Correct use of language, grammar, spelling and punctuation.

B2 Interview skills

Creating an impression through effective communication.

- Preparation and presentation skills, including:
  - planning and practice for the interview
  - interview styles, e.g. competency or behaviour-based, knowledge-focused
  - personal appearance and hygiene
  - interpersonal skills and attitude
  - body language.
- Listening and talking skills, including:
  - interview conventions
  - use of language – what is/what is not appropriate
  - building rapport
  - developing a dialogue
  - effective listening and questioning
  - non-verbal communication, e.g. eye contact.

B3 Reflecting on preparation and performance

- Reflecting on preparation for interviews and interview performance, including knowledge of employer and role, communication skills, professional behaviour.

Learning aim C: Undertake work experience in the land-based sector to contribute to personal and professional development

C1 Practical work experience

Operating in workplace practices, including:

- knowledge of the purpose of the business and/or environment
- knowledge of reporting procedures with regard to behaviour and expectations, e.g. lateness, sickness, emergency
- health and safety protocols, e.g. fire safety, emergency procedures
- procedures to maintain confidentiality
- practical experience in a land-based working environment for a minimum of 60 hours (this is distinct from the 60 GLH for this unit).

C2 Work behaviours

- Completion of role to add value in the workplace:
  - understanding the extent and limitation of own roles and responsibilities
  - carrying out tasks according to roles and responsibilities
  - following instructions
  - communicating with others
  - self-management
  - working safely
  - reliability, regular attendance and commitment
  - punctuality
  - use of initiative
  - cooperation with colleagues and end users, e.g. customers, clients, other organisations.
- Obtaining feedback, including:
  - timesheets signed by an appointed person at work experience employment, confirming appropriate attendance and punctuality
  - employer or teacher observation/witness statements
  - employer feedback sheets, provided at intervals.

C3 Reflecting on workplace practice

Reflecting on personal performance in relation to own career progression, to include:

- formative feedback from employer(s), colleagues, teacher, stakeholders
- performance self-assessment
- review of areas for development, to include SWOT (strengths, weaknesses, opportunities, threats) analysis, SMART (specific, measurable, achievable, relevant, time-based) target setting, knowledge of SWOT and SMART in learning development.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Investigate land-based employment opportunities to target progression</td><td rowspan="4">A.D1 Evaluate how effective preparation for work experience can significantly enhance employment prospects.
B.D2 Evaluate own preparation for and performance in work experience interview, including review of all future opportunities.</td></tr>
<tr><td>A.P1 Explain the value of own research and preparation carried out for work experience, related opportunities and progression routes.
A.P2 Explain accurately the relevant legislation relating to a work placement.</td><td>A.M1 Analyse the value of own research and preparation carried out for work experience, related opportunities and progression routes.</td></tr>
<tr><td colspan="2">Learning aim B: Develop communication and interview skills to improve employment prospects in the land-based sector</td></tr>
<tr><td>B.P3 Explain the preparation and research carried out for a work experience interview.
B.P4 Demonstrate communication and interpersonal skills as an interviewee for a selected work experience.</td><td>B.M2 Perform proficiently as an interviewee for a selected work experience, using appropriate communication and interpersonal skills.</td></tr>
<tr><td colspan="2">Learning aim C: Undertake work experience in the land-based sector to contribute to personal and professional development</td><td rowspan="2">C.D3 Evaluate the effectiveness of the work experience carried out in improving occupational and personal skills to make best use of opportunities for employment.</td></tr>
<tr><td>C.P5 Explain how the work experience undertaken has improved occupational and personal skills for future opportunities.
C.P6 Review how own performance during work experience contributed to the employer.</td><td>C.M3 Assess the value of the occupational and personal skills developed during work experience for future opportunities.
C.M4 Analyse the impact on the employer of own performance during work experience.</td></tr>
</table>

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.M4, C.D3)

Further information for teachers and assessors

Resource requirements

There are no special resources needed for this unit.

Essential information for assessment decisions

Learning aims A and B

For Distinction standard, learners will produce a written report evaluating the quality of their own preparation when seeking work experience. This will include their investigation and research carried out, completion of application documents adapted for specific roles, and completion of a mock interview or employer-evidenced real interview. The report will include conclusions about the quality of each step of the preparation, linking this to the teacher's evaluation of the mock interview and the chance of securing employment. Learners will write a conclusion that includes clear understanding of best practice in this area.

For Merit standard, learners will produce a written analysis of the quality of their own preparation when seeking work experience. This will include their investigation and research carried out, completion of application documents adapted for specific roles, and completion of a good mock interview or employer-evidenced real interview. The analysis will include a detailed examination of each step of the preparation, linking this to the chance of securing employment. Learners will include an analysis of the teacher's evaluation of the mock interview.

For Pass standard, learners will consider the value of their own preparation when seeking work experience, for example investigation and research carried out, completion of application documents adapted to specific roles, and completion of a mock interview or employer-evidenced real interview. Learners will include links to the teacher's evaluation of the mock interview. Learners could include a SWOT analysis.

Learning aim C

Learners need to review and reflect on their time undertaking work experience. This will relate to the number of hours required by the qualification.

For Distinction standard, learners will undertake work experience and supply reasoning in their reflective reports to determine the effectiveness of the completed work experience and its capacity to improve their opportunities for employment. Their reasoning will consider the relationship between the occupational and personal skills developed during the work experience and how these may help them in securing future employment. The relationship between learners' own performance during work experience and its impact on the employer will also be covered. Learners will consider how well they prepared themselves for the work experience activities in order to gain the most from the experience(s). Learners' reflections should take account of employer and teacher feedback, and observations of them during their work experience.

For Merit standard, learners will undertake work experience and present in their reflective reports a relationship between the occupational and personal skills developed during the work experience, and a discussion about how these skills will help secure employment. Learners will consider the relationship between their own performance during the work experience and its impact on the employer. Learners' reflections should take account of employer and teacher feedback, and observations of them during their work experience.

For Pass standard, learners will undertake work experience and present in their reflective reports a consideration of how they developed different occupational and personal skills during their placement. Learners will make a formal assessment of their own performance during work experience based on feedback, including a SWOT analysis, and link this to their contribution to the employer. Learners' reflections should take account of employer and teacher feedback and observations of them during their work experience.

Links to other units

This unit links with all others in the specification.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- practical application when reflecting on experiences of work
- safe working practices and procedures when working.

Unit 8: Animal Production Systems

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

This unit introduces learners to animal production systems in the context of local, national and global agriculture.

Unit introduction

Animal production is of vital importance to the global agricultural industry and there are many diverse ways to utilise the products that farmed animals provide. Maximising the efficiency of production systems involves working with local land conditions and resources, and in the context of regional, national and international legislation and consumer demand.

In this unit, you will explore contemporary issues in relation to farming animals. You will find out about different production systems, requirements and indicators of performance at different stages of producing animals, from bloodline selection to full maturity. You will also look at how the health of animals and humans – from farmers to consumers – is protected throughout the animal production process.

This unit will support you in progressing to employment in the land-based sector or to further study in higher education.

Learning aims

In this unit, you will:

A Explore the role of animal production in agriculture

B Investigate animal production systems

C Examine animal and human health protection during animal production.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore the role of animal production in agriculture	**A1** Factors affecting animal production **A2** Animal production in agriculture	A case study and report on the measures taken to protect animal and human health during animal production.
B Investigate animal production systems	**B1** Housing and husbandry requirements **B2** Animal growth and maturity **B3** Performance indicators	
C Examine animal and human health during animal production	**C1** Human health **C2** Animal health	

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Content

Learning aim A: Explore the role of animal production in agriculture

A1 Factors affecting animal production

- Purposes of animal production, including meat, milk, wool, eggs.
- Domestic and commercial breeds, including suitability for different production systems and areas.
- Current conditions in the local, national and international industry, including current stock numbers, range of products and consumer trends, locally and globally.
- Geographic and economic factors affecting animal production at producer and national level, including climate, altitude, seasonal changes, soil fertility, requirement for, and availability of, land for production purposes.
- Availability of financial assistance at local, national and international levels, e.g. quotas, funds, grants, loans.
- Factors affecting choice of system, including financial, economic, marketing, availability of services, current farming practices, environmental factors and current legislative requirements.

A2 Animal production in agriculture

- Roles of business owners, employees and contractors in small-, medium- and large-scale animal production.
- Local, national and international economic contribution of animal production.
- Intensive and extensive animal production systems.
- Methods of sharing best practice, including government education programmes, industry publications and organisations, networking.
- Environmental impact, waste management and pollution control.
- Issues associated with large-scale production systems, including design, purpose, work routines, allocation and roles of staff, stock turnover.

Learning aim B: Investigate animal production systems

B1 Housing and husbandry requirements

- Local climate and requirements for a production environment:
  - environment needs, e.g. heating, cooling, ventilation, lighting
  - environment maintenance equipment, e.g. fans, vents, heaters, controls, alarms, failsafe generators
  - measuring equipment, e.g. thermometers, hygrometers, airspeed meters.
- Environment assessment, including adjustments and adaptations to maximise welfare and profit.
- Impact of accommodation design and construction on animal health and welfare and the environment.
- Provision, cleaning and storage of feed and water, including feeding and watering, measuring, delivery equipment/systems.
- Assessment of basic feed suitability and quality.
- Key animal health assessments.
- Production resources and equipment, e.g. milking, egg collection, shearing.
- Planning, monitoring and recording systems, e.g. feed, health and production plans, written records, databases and online recording systems.

- Waste management.
- Current relevant legislation and restrictions for all stages of the production cycle.

B2 Animal growth and maturity

- Changes to nutritional requirements at different life stages of growth and maturity in livestock:
  - energy requirements
  - feed intake and types
  - supplements.
- Monitoring and recording of growth stages, including body weight and condition, fat deposition, signs of maturity.

B3 Performance indicators

- Measurement: sampling, including random sample, representative sample, daily live weight gains, automatic, feed, water, medication, temperature, ventilation, consumption.
- Performance targets and indicators:
  - breed standards
  - commercial targets, e.g. body weight, yield, mortality, food conversion rate (FCR), fertility.
- Selection of breeding stock, including analysis of previous bloodline performance.
- Records, including computers, graphs and charts, storage, veterinary, deaths and disposal, husbandry.

Learning aim C: Examine animal and human health protection during animal production

C1 Human health

- Common transmissible and zoonotic diseases and pathogens in livestock, including collaboration at local, national and global levels to ensure consumer protection from animal-sourced diseases and pathogens.
- Accountability and traceability in the food production chain.
- Prevention and control of hazards from primary production to processing.
- Biosecurity measures for workers, visitors, accommodation and vehicles.
- Health and safety factors associated with animal movement and transport, pest and vermin control, waste, water, people, equipment.

C2 Animal health

- Factors affecting the spread of disease, including movement and transport of stock, interactions with wild animal populations, including local, national and international interventions to address epidemics.
- Legislation, regulations and standards in key aspects of animal production health and welfare, including:
  - culling
  - housing and husbandry
  - stock levels
  - preparation and transport of animals for market or to slaughter
  - physiological and psychological stress.

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Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Explore the role of animal production in agriculture</td><td rowspan="4">AB.D1 Evaluate the success of an animal production system.</td></tr>
<tr><td>A.P1 Explain factors affecting animal production.
A.P2 Describe challenges and opportunities for animal production.</td><td>A.M1 Analyse factors affecting animal production.</td></tr>
<tr><td colspan="2">Learning aim B: Investigate animal production systems</td></tr>
<tr><td>B.P3 Outline housing and husbandry requirements for an animal production system.
B.P4 Explain the use of records during animal production.</td><td>B.M2 Assess the effectiveness of an animal production system.</td></tr>
<tr><td colspan="2">Learning aim C: Examine animal and human health protection during animal production</td><td rowspan="2">C.D2 Evaluate measures taken to protect animal and human health during animal production.</td></tr>
<tr><td>C.P5 Identify animal health and welfare issues during animal production.
C.P6 Describe how animal production methods affect human health.</td><td>C.M3 Analyse factors affecting animal and human health during animal production.</td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, AB.D1)

Learning aim: C (C.P5, C.P6, C.M3, C.D2)

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Further information for teachers and assessors

Resource requirements

There are no special resources needed for this unit.

Essential information for assessment decisions

Learning aims A and B

For Distinction standard, learners will provide clear and concise arguments to competently judge the factors that contribute to the success or otherwise of animal production system. They will consider the local, national and global factors affecting the production systems, using detailed lines of reasoning for the judgements they make. Learners will provide a comprehensive account of the housing, husbandry and record-keeping requirements for an animal production system, giving a thorough review of improvements that could be made. They will draw appropriate conclusions that demonstrate in-depth knowledge and understanding of animal production methods. Learners will use detailed research analysis to support their recommendations for improvements.

For Merit standard, learners will carefully consider the local, national and global factors affecting animal production, demonstrating knowledge and understanding of how they shape the way an animal production system operates. Learners will give reasons for how appropriate a production system is, drawing suitable conclusions about how that production can be maximised through housing, husbandry and record-keeping practices. They will make analytical judgements and use specific examples to support points made, showing awareness of different methods of production.

For Pass standard, learners will identify local, national and global issues affecting production animals and systems, giving reasons as to why they are important and recognising challenges and opportunities for animal producers. They will give a realistic account of the housing and routine tasks needed to manage production of animals. Learners will demonstrate knowledge and understanding of record keeping in order to comply with guidance and legislation, and the use of records in managing production efficiency. They will refer to their independent research.

Learning aim C

For Distinction standard, learners will demonstrate thorough knowledge and understanding of the effect of production practices on animal health and welfare. They will consider the effectiveness of the controls put in place to safeguard the end consumer as well as the health and safety of those involved in animal production systems and processes. They will provide articulate arguments for any conclusions and recommendations made on improving standards of animal and human health and welfare.

For Merit standard, learners will demonstrate knowledge and understanding of how production practices can affect the health and welfare of animals and humans. They will give detailed consideration of how the health of the end consumer and those involved in animal production is maintained throughout the animal production process.

For Pass standard, learners will demonstrate some knowledge and understanding of how production practices can affect animal health and welfare at different points in the production process. They will show understanding of the ways in which human health can be affected by animal production processes and the controls that protect the health and safety of both the end consumer and those involved in animal production.

Links to other units

This unit links to:

- Unit 9: International Poultry Production
- Unit 12: International Sheep Production
- Unit 13: International Beef Production
- Unit 14: International Dairy Production.

Employer involvement

This unit would benefit from employer involvement in the form of:

- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills
- presentation skills
- written and verbal communication skills.

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Unit 9: International Poultry Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills and knowledge needed to carry out feeding and husbandry practices to raise poultry successfully in poultry production systems.

Unit introduction

The poultry production industry often involves mainly three species: chickens, ducks and turkeys. It also involves a wide variety of housing and husbandry methods. Workers in the industry might be specialists, working with one stage of the life cycle of the bird and caring for hundreds of thousands of birds at one time, or they might work with poultry as part of a larger, more diverse enterprise.

In this unit, you will investigate different commercial poultry systems, including the range of housing systems associated with each type of production system, and select appropriate accommodation, taking into account any animal welfare issues. You will carry out routine husbandry and feeding tasks for one or more classes of commercial poultry, which might include broiler production, commercial layers (used to produce eggs for consumption), ducks and turkeys. You will find out how production affects animal welfare and develop skills in meeting the nutritional requirements of poultry at different stages in the production cycle, including feed ingredients and ration formulation. You will develop a clear understanding of the legal, economic and environmental factors that contribute to decision making in poultry production. This will allow you to make informed decisions in relation to future poultry production.

This unit will help you to progress to employment in poultry production units, or to higher-education courses in areas such as animal science, agricultural business or agriculture.

Learning aims

In this unit you will:

A Investigate poultry production systems

B Carry out diet management and feeding practices during the production cycle to maintain health and production targets

C Carry out routine husbandry of poultry during the production cycle to meet current welfare and husbandry standards.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate poultry production systems	**A1** Poultry production systems **A2** Housing requirements **A3** Selection of animals for market and the role of performance indicators	A written report on a selected poultry production system and the production cycle.
B Carry out diet management and feeding practices during the production cycle to maintain health and production targets	**B1** Nutritional requirements **B2** Diet management and feeding practices **B3** Nutritional problems	A portfolio of evidence, to include: • planning documents • evidence of carrying out routine poultry husbandry and feeding tasks safely to meet current standards and health and production targets.
C Carry out routine husbandry of poultry during the production cycle to meet current welfare and husbandry standards	**C1** Routine husbandry **C2** Breeding poultry **C3** Assessing health and welfare	

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Content

Learning aim A: Investigate poultry production systems

A1 Poultry production systems

Chicken, duck and turkey production systems and associated considerations and processes for each.

- Current national conditions in the poultry industry, including poultry numbers, range of poultry products, current rearing trends, current national and global consumer trends.
- Poultry production systems:
  - intensive systems, including cages, barns, deep litter
  - free range and organic systems
  - extensive systems of rearing.
- Factors affecting choice of system, including financial, economic, marketing, availability of services, current farming practices, environmental factors and current legislative requirements.
- Class of poultry, including broilers, breeders, commercial layers, turkey breeders, turkey growers, duck breeders, growing ducklings, growers and layers, day-old and young birds, point-of-lay birds, breeders, commercial layers.
- Domestic and commercial poultry breeds, including suitability for different production systems.
- Biosecurity measures in poultry production, including disinfectant foot dips, lorry wheel wash.
- Environmental impact and pollution control.
- Other factors associated with health and safety, including biosecurity levels, movement and transport of poultry, pest and vermin control, feeding, water and bedding, people, equipment.
- Legislation and welfare standards in key aspects of poultry production, including:
  - culling
  - husbandry
  - sustainability
  - welfare, including beak trimming, transport, slaughter, overcrowding, physiological and psychological stress.

A2 Housing requirements

Variety of housing and associated equipment used in production systems.

- Consideration of poultry housing in production systems:
  - considerations, including insulation, lighting, feeding, drinking and nesting equipment
  - cage systems, including conventional cages, enriched cages
  - egg collection systems, including automatic cage systems, automatic and manual nesting systems, manual systems, slats
  - egg storage until sale
  - waste management, including bedding, faeces, feed, eggs
  - current relevant legislation and restrictions for all stages of the production cycle
  - adjustments and adaptations (equipment, lighting, ventilation) to maximise profit
  - impact, including on animal health and welfare, on the environment, on building design.

- Equipment, including fans, vents, heaters, controls, alarms, failsafe generators, natural and fan-assisted.
- Measuring equipment, including thermometers, hygrometers, digital measuring equipment, airspeed meters.
- Environment assessment in hot and cold weather conditions, including lighting and lighting patterns, temperature.
- Ventilation, including air quality, airflow, minimum ventilation rates, ventilation control.
- Evaporative cooling systems.

A3 Selection of animals for market and the role of performance indicators

- Measurement: sampling, including random sample, representative sample, coefficient of variation (CV%), automatic, feed, water, medication, temperature, ventilation, consumption.
- Performance targets:
  - breed standards
  - commercial targets, including weight for age.
- Current relevant regulations regarding preparation of animals for market/slaughter, including those governing the transport of livestock, completion of movement records, health and safety, animal welfare.
- Records, including computers, graphs and charts, storage, veterinary, deaths and disposal, husbandry.
- Performance indicators, including body weight, variation, egg numbers, egg weight, egg mass, egg quality, mortality, food conversion rate (FCR), fertility, hatchability, hen-housed.

Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets

B1 Nutritional requirements

- Nutritional requirements of the flock at the different stages of growth:
  - nutritional requirements of chicks, pullets
  - energy requirements and feed intake
  - body weight and fat deposition in relation to egg laying
  - formulation of rations for poultry to meet target growth and production rates.
- Types of feed, including pellets, crumbles, mash, starter feed, grower feed, layer feed.

B2 Diet management and feeding practices

- Feeding strategies, including ad libitum, restricted.
- Types of diet available: starter, broiler, growth-to-finishing diets for chickens, turkeys and ducks.
- Types of feeding and watering equipment, including feed pans, self-feeders, automatic feeders, nipple drinkers, round drinkers, water delivery systems.
- Cleaning and maintenance of feeding and watering equipment.
- Assessment of basic feed quality for suitability.
- Recording systems, including feed boards, databases and online recording systems.
- Facilities for feed storage to maintain quality.
- Weight gain and maintenance at each life stage.

B3 Nutritional problems

- Common nutritional health issues, including rickets, caged layer fatigue (CLF), other specific micronutrient deficiencies.
- Causes, treatments and prevention of common nutrition deficiencies, excesses and disorders.

Learning aim C: Carry out routine husbandry of poultry during the production cycle to meet current welfare and husbandry standards

C1 Routine husbandry

Routine husbandry for commercial poultry flocks to maintain health and ensure high levels of animal welfare.

- Routine husbandry:
  - preparation of housing and environment
  - cleaning of housing and equipment using approved products
  - bedding, including type, frequency of change, disposal
  - maintaining environment, including ventilation, temperature, lighting, basic litter management
  - equipment, including feeders, drinkers, heaters, fans, ventilation control systems
  - establishment and maintenance of biosecurity measures, including strict hygiene and disinfection procedures, use of approved disinfectants, use of personal protective equipment (PPE)
  - feeding and watering
  - routine checks of health and welfare
  - role of veterinary medicines in treating and controlling disease
  - responsible use of veterinary medicines under the relevant rules/regulations to prevent or control exposure to disease, reading the label and data sheets, engineered controls, competence and training requirements
  - record keeping, including veterinary medicines book, record or births and deaths and husbandry records
  - legislative requirements, codes of practice
  - daily routine practices, including feather clipping, tagging, external parasite control
  - bird handling and restraint techniques.
- Issues associated with large-scale poultry production systems, including design, purpose, work routines, allocation and roles of staff, flock cycles, challenges.

C2 Breeding poultry

Factors to consider for successful poultry breeding and rearing:

- anatomy of the egg, formation and structure
- assessment of egg quality for incubation and to enter the food chain
- factors affecting growth and reproduction
- breeding stages, including incubation, egg hatching, brooding
- administering medication via water and feed supply
- reasons for administering medication
- environmental controls, temperature, humidity, lighting, ventilation, density of birds.

C3 Assessing health and welfare

- Routine inspections, including process and frequency for mature birds and chicks, leg health.
- Health checking using indicators of good health, including clear, bright eyes, alertness, good posture, vigorous movements if unduly disturbed, active feeding and drinking, singing and vocalisation, satisfactory egg production and clean and healthy skin, shanks and feet.
- Poor welfare indicators, including feather loss, leg burns, excessive gapping, stocking densities, poor handling techniques.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Investigate poultry production systems</td><td rowspan="2">A.D1 Demonstrate proficient selection of animals for market and end of use, evaluating the impact of a poultry production and housing system and accurate selection on overall performance and production outcomes.</td></tr>
<tr><td>A.P1 Explain a poultry production and housing system, including the impact on animal health and welfare.
A.P2 Demonstrate competent selection of animals for market and end of use.</td><td>A.M1 Analyse the impact of a poultry production and housing system and accurate stock selection on overall performance and production outcomes.
A.M2 Demonstrate effective selection of animals for market and end of use.</td></tr>
<tr><td colspan="2">Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets</td><td rowspan="3">B.D2 Demonstrate, with a high degree of accuracy, feeding and diet management of poultry to maintain health and production targets, evaluating the impact of nutrition and own feeding and diet management tasks.
C.D3 Demonstrate, with a high degree of accuracy, routine husbandry and assessment of health and welfare of poultry in a commercial system to maintain health and production objectives.</td></tr>
<tr><td>B.P3 Explain the importance of diet management and feeding practices throughout the poultry production cycle.
B.P4 Demonstrate competent feeding and diet management of poultry to maintain health and production targets.</td><td>B.M3 Analyse the impact that nutrition, diet management and feeding have on health and production targets.
B.M4 Demonstrate efficient feeding and diet management of poultry to maintain health and production targets.</td></tr>
<tr><td colspan="2">Learning aim C: Carry out routine husbandry of poultry during the production cycle to meet current welfare and husbandry standards</td></tr>
<tr><td>C.P5 Demonstrate competent routine husbandry of poultry to meet health and production targets.
C.P6 Demonstrate competent assessment of poultry health and welfare in a commercial system.</td><td>C.M5 Demonstrate efficient routine husbandry and assessment of health and welfare of poultry in a commercial system to meet health and production targets.</td><td></td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M3, B.M4, C.M5, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- commercial poultry of different species, including chickens, ducks, turkeys
- poultry at the centre
- routinely used equipment.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give an in-depth review of one poultry production and housing system for a specified poultry species, thoroughly considering breed suitability and how accurate selection affects overall production outcomes. They will make comprehensive, accurate connections between key factors within the production system and the requirements to select the most suitable breed to meet production targets. Learners will carry out a comprehensive review of secondary information on the selected production method, with robust evaluation of the advantages and disadvantages, and logical justifications regarding the most suitable breeds. They will show depth of understanding to correctly identify those animals ready for sale at market or end of use, giving valid, well-reasoned justifications for their views. Learners will show breadth and depth of understanding of the importance of performance indicators as a measure of success and the implications on health and welfare, using specific terminology accurately throughout. Learners will recommend relevant, insightful strategies consistently, to improve animal welfare in the production cycle.

For Merit standard, learners will make relevant, analytical judgements on one poultry production and housing system for a specified species and on overall production outcomes. They will make mainly relevant connections between the different aspects of the production system and the requirements to select the most suitable breed or species to meet production targets. Learners will provide a clear review of secondary information on the selected production method and housing system, with a clear analysis of the advantages and disadvantages. They will give mostly valid justifications for the choice of suitable breeds. Learners will show breadth and some depth of understanding when identifying those animals ready for sale at market or end of use, giving mostly valid justifications for their views. They will show breadth and some depth of understanding of performance indicators as a measure of success and the implications on health and welfare. The evidence will use specific, accurate terminology. Learners will, at all times, show relevant and realistic consideration of animal welfare in the production cycle, making mostly relevant recommendations for improvements.

For Pass standard, learners will give a limited, realistic account of one poultry production and housing system for a specified poultry species and breed suitability, showing basic understanding of how accurate selection affects overall production outcomes. They will make basic connections between the key factors within the production and housing system and the requirements for selecting the most suitable breed to meet production targets. Learners will use some secondary information on the chosen production method to identify the advantages and disadvantages, giving basic

explanations for their choice of the most suitable breeds. They will recall knowledge to identify those animals ready for sale at market or end of use but will not provide justifications for their views. Learners will show limited breadth and depth of understanding of performance indicators as a measure of success and the implications for health and welfare, using some relevant terminology. Learners will, at all times, consider animal welfare in the production cycle, identifying basic changes that could be made.

Learning aims B and C

In order to achieve learning aims B and C, learners must demonstrate the required knowledge and skills within the context of a chosen poultry production system. Teachers should ensure that the poultry production system selected by learners provides sufficient scope for them to fully complete the assessments.

For Distinction standard, learners will demonstrate the practical skills required to care for a production flock and individual animals in a poultry system to a standard that reflects best practice in the workplace. They will carry out all the practical tasks confidently, showing a high degree of initiative within the limits of their responsibility.

Learners will evidence insightful strategies to minimise risks, demonstrating proficient safe working practices throughout. They will select the correct equipment, using it safely and accurately. They will ensure that animal welfare is maintained effectively and disruption to the animals is minimised. Learners will demonstrate proficiency in complying with biosecurity policies and procedures. They will show depth of understanding of the activities affected by biosecurity, how to take action to prevent non-compliance, and the consequences of biosecurity breaches. Learners will keep detailed and accurate records as appropriate to the tasks being carried out.

Learners will carry out feeding and diet management with a high degree of accuracy, ensuring the required foodstuffs are available and prepared, and informing others if there are problems. They will show depth of understanding of the importance of diet management within a poultry production system through a detailed review of nutritional requirements, feeding practices and common nutritional problems, with well-reasoned recommendations for improvement.

Learners will carry out routine husbandry activities with one poultry species, including feeding, watering, cleaning, assessing the environment, bird inspection and managing overall health. They will demonstrate a robust understanding of the practices used to care for the animals. Learners will make convincing connections between good husbandry and healthy birds. They will show in-depth understanding of the importance of animal welfare and the need to review and maintain it as part of normal operation. Learners will show clear understanding that recognising and dealing with ill health in poultry is part of routine husbandry, demonstrating this when carrying out their activities. They will review their approaches to carrying out routine husbandry activities and feeding and diet management in terms of their effectiveness in maintaining good health and hygiene of livestock. Learners will explore thoroughly where they were successful and where approaches could be improved or carried out differently.

Learners' evidence will use specific, accurate terminology throughout.

For Merit standard, learners will demonstrate the practical skills required to care efficiently and safely for a production flock and individual animals in a poultry system. They will carry out the practical tasks competently and show some initiative within the limits of their responsibility. Learners will show efficient use of time and resources, and meet key requirements for animal welfare. They will assess the risks and hazards, using the required equipment safely and competently. Learners will demonstrate competency in complying with biosecurity policies and procedures. They will show clear understanding of most of the activities that are affected by biosecurity and how to take action to prevent non-compliance. Learners will keep records, as appropriate to the tasks and with sufficient detail, so it is clear what has been carried out.

Learners will carry out feeding and diet management correctly, making efficient use of resources, and with some preparation of foodstuffs. They will show a clear understanding of the importance of diet management systems through providing details of the nutritional requirements, feeding and diet practices and nutritional problems commonly seen in commercial poultry production, making mostly valid recommendations for improvement.

Learners will carry out competently routine husbandry activities with one poultry species, including feeding, watering, cleaning, assessing the environment, bird inspection and managing overall health. They will demonstrate a sound understanding of the practices used to care for the animals, making relevant connections between good husbandry and healthy poultry. Learners will demonstrate a clear understanding of the importance of animal welfare and the need to maintain it as part of normal operation. They will understand that recognising and dealing with ill health in poultry is part of routine husbandry, demonstrating this when carrying out some of their activities, but there may be minor omissions. Learners will reflect on the approaches they used and make clear connections to their impact on the good health and hygiene of livestock, with mainly relevant recommendations for improvement.

Learners' evidence will show use of specific, appropriate technical terminology.

For Pass standard, learners will demonstrate the practical skills required to care safely and competently for a production flock and individual animals within a poultry production system. They will carry out the practical tasks appropriately, showing little initiative within the limits of their responsibility.

Learners will work safely, with a realistic, limited awareness of the risks and potential issues arising when carrying out routine feeding and husbandry in a poultry production system. They will use the appropriate equipment and leave the area clean and tidy on completion. Learners will show a realistic awareness of the importance of complying with biosecurity policies and procedures. They will recall knowledge of most activities that are affected by biosecurity and outline actions to prevent non-compliance. Learners will show an awareness of the need to keep appropriate records, providing the key information.

Learners will carry out feeding and diet management safely and competently, demonstrating a realistic, limited awareness of the importance of minimising wastage of resources. They will show basic understanding of the significance of the role of feeding and diet management in the production cycle. Learners will recall basic knowledge to explain the nutritional requirements, feeding and diet practices, and nutritional problems commonly seen in a commercial poultry production system.

Learners will carry out routine husbandry activities with one poultry species, including feeding, watering, cleaning, assessing the environment, bird inspection and managing overall health. They will demonstrate some relevant understanding of the practices used to care for the animals. Learners will carry out basic routine care and identify tasks to be completed in a generally appropriate order. They will make basic, realistic links between good husbandry and healthy poultry. Learners will show an appropriate awareness of how to maintain the welfare of animals as part of normal operation and the need to maintain it at all times. They will show realistic awareness that recognising and dealing with ill health in poultry is part of routine husbandry, demonstrating this when carrying out some of their activities, but this will be limited. Learners will demonstrate a realistic but undeveloped understanding of how the approaches they used link to the good health and hygiene of livestock.

Learners' evidence will use some relevant terminology, but there may be omissions.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 10: Farm Livestock Husbandry
- Unit 16: Livestock Nutrition.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- presentation and interpersonal skills when working with others
- analytical and evaluative practices
- mathematical skills and knowledge when analysing animal nutrition and production systems.

Unit 10: Farm Livestock Husbandry

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners study the breadth and purposes of farm livestock, including husbandry techniques required to maintain animal welfare and aid productivity.

Unit introduction

Supplying the world with animal products such as meat, dairy and wool requires knowledge about how to raise, care for and handle a variety of farm livestock successfully. The successful farmer needs to balance productivity with high standards of animal welfare.

In this unit, you will explore a range of farming systems and develop specialist knowledge and understanding of farmed livestock handling and husbandry. You will explore farm livestock nutrition and feed systems, creating balanced diets that meet the needs of the animal and the producer. You will develop the skills and experience needed to confidently and safely manage large and sometimes unpredictable animals.

This unit will support your progression to employment with common farm livestock, or to further study in an apprenticeship or higher-education establishment.

Learning aims

In this unit you will:

A Understand the production systems used for farm livestock

B Explore the nutritional needs of farm livestock in order to maintain good standards of health

C Carry out handling and routine husbandry of farm livestock to meet current standards.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Understand the production systems used for farm livestock	**A1** Farm livestock types and breeds **A2** Production systems	An illustrated report/essay examining the common and unconventional farm livestock species, and how these are produced.
B Explore the nutritional needs of farm livestock in order to maintain good standards of health	**B1** Nutrition for farm livestock **B2** Feeding and watering regimes and equipment **B3** Feed ration formulation	Portfolio of evidence relating to the practical handling, feeding, watering and husbandry of farm livestock species. A report examining feeds and composition, equipment, methods and techniques of feeding and watering.
C Carry out handling and routine husbandry of farm livestock to meet current standards	**C1** Health and safety requirements when working with farm livestock **C2** Animal health checks prior to handling common species **C3** Practical animal handling techniques and equipment for common farm livestock species **C4** Farm animal accommodation	

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Content

Learning aim A: Understand the production systems used for farm livestock

A1 Farm livestock types and breeds

Characteristics and purposes of livestock breeds, including native and imported.

- Sheep for food, wool and by-products, including pure-bred and cross-bred sheep, e.g. Border Leicester, Suffolk, Jacob, Lincoln Longwool, Texel, Charollais and Merino.
- Poultry for meat, eggs and by-products, hybrid and pure breeds, e.g. Buff Orpington, Araucana, Legbar, Faverolles, Aylesbury ducks.
- Cattle for beef, dairy, and by-products, e.g. Hereford, Red Poll, Longhorn, Angus, Welsh Black, Galloway, Jersey, Limousin.
- Goats for milk, meat and by-products, including hybrid and pure breeds, e.g. Bagot, Golden Guernsey, Angora, Karystos, Skeopelos and Boer.
- Other livestock diversification, e.g. ostriches for meat, alpacas for fleece, crocodiles for skins.

A2 Production systems

- Variety and characteristics of common production systems for common livestock and standards of welfare and quality of product produced:
  - intensive, organic, semi-intensive, extensive
  - poultry (broilers, laying hens)
  - cattle (beef and dairy)
  - sheep (lowland, upland, hill)
  - fish (extensive and intensive)
  - mega-farming systems – dairy, poultry and beef
  - sustainability and suitability of systems – water conservation/drought, pollution and impact of each on animal/human health
  - slaughter practices for each group, including cultural and ethical issues
  - welfare monitoring and measuring, legal obligations for all systems.
- Unconventional livestock production systems and standards of welfare and quality of product produced, e.g. ostrich, alpaca, crocodile.
- Impact on production and welfare of supply and demand, time constraints, costs.
- Class of stock, ages of stock, length of time animals are in production.

Learning aim B: Explore the nutritional needs of farm livestock in order to maintain good standards of health

B1 Nutrition for farm livestock

The purpose of understanding feeds, composition and nutritional requirements of species to maximise the value of the animal, including:

- feed types, straights, blends, compound feed, concentrates, forage and fodder
- hay, haylage, silage and straw production
- nutrient requirements for farm species
- absorption and utilisation of nutrients in feed by species
- palatability of feeds and impact on behaviour.

B2 Feeding and watering regimes and equipment

- Feeding and watering equipment from protocols for livestock species, including:
  - automatic drinkers
  - plastic and metal troughs
  - buckets and bucket feeders
  - mobile and fixed hay racks
  - automatic feeding systems.
- Developing productive feeding protocols for livestock species to maximise the value of the animal, to include:
  - planning nutrition
  - charts and records
  - storage of feeds, including regulations and practical considerations
  - preparation of feed
  - hygiene
  - personal protective equipment (PPE).

B3 Feed ration formulation

Methods and techniques in ration formulation.

- Balancing rations using algebraic methods, the Pearson square and computer formulation software, e.g. Format International.
- Creating the 'least cost' rations.
- Testing the results for accuracy and making adjustments to feeding of the species, if needed.

Learning aim C: Carry out handling and routine husbandry of farm livestock to meet current standards

C1 Health and safety requirements when working with farm livestock

- Health and safety legislation (or international equivalents) related to eliminating hazards and controlling risks.
- Risk assessments, including identifying health and safety requirements for self, other people and animals, when working with livestock.
- PPE.
- Principles of handling livestock safely and securely in a farm environment.

C2 Animal health checks prior to handling common species

- Visual health assessments.
- Behavioural assessments, including species-specific behaviour, patterns, interaction with other animals.

C3 Practical animal handling techniques and equipment for common farm livestock species

- Cattle, sheep, poultry – handling safely and humanely.
- Restraining and handling equipment and systems, including tethers, halters, ropes, bull poles, boards, paddles, flat slap sticks, electric fencing, crushes, yoke units, pens, hurdles, crates, cattle races.
- Use of weighing scales.
- Handling animals in different locations inside and in the open, loading and unloading for transport, e.g. for sale and slaughter.
- Body condition scoring/assessment.

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C4 Farm animal accommodation

Accommodation considerations, including:

- indoor and outdoor accommodation
- types, structures, materials
- maintenance of accommodation for security and safety of animals and humans
- disposal of organic and inorganic waste
- impact of accommodation considerations on production and production costs
- impact of accommodation on animal welfare, including stress
- requirements for animals at different life stages
- legislation and codes of practice specific to common farm livestock
- application of the five welfare needs.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand the production systems used for farm livestock		**A.D1** Evaluate the suitability of livestock production systems for different species, giving recommended changes.
A.P1 Explain the characteristics of different production systems. **A.P2** Explain why different production systems for different breeds can affect animal welfare in different ways.	**A.M1** Assess the different factors of livestock production systems for different species of farm livestock.	
Learning aim B: Explore the nutritional needs of farm livestock in order to maintain good standards of health		**B.D2** Carry out techniques proficiently, to evaluate diets and feeding strategies designed and recorded for different species of farm livestock, making coherent recommendations for improvement to promote higher welfare.
B.P3 Explain the nutritional requirements for different species of farm livestock. **B.P4** Carry out procedures to balance and record animal rations for different species. **B.P5** Explain the correct feeding and watering equipment for farm livestock species.	**B.M2** Analyse and record correct feed ingredients for nutritional composition of feed for different species of farm livestock.	
Learning aim C: Carry out handling and routine husbandry of farm livestock to meet current standards		**C.D3** Evaluate use of husbandry techniques in maintaining livestock to meet current standards.
C.P6 Demonstrate correct techniques for routine cleaning, maintenance, feeding and watering of different livestock species. **C.P7** Demonstrate correct standard health and safety practices when assessing and handling farm livestock.	**C.M3** Demonstrate proficient handling techniques and use of equipment to assess condition, clean and maintain different species of farm livestock.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, B.P5, C.P6, C.P7, B.M2, C.M3, BC.D2, BC.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- regular access to farm livestock, sheep, cattle (beef and dairy), poultry (chickens and ducks) and alternative livestock species, as per content
- species-specific handling equipment (cattle crush and race, sheep turner, boards, hurdles, electric fencing, sheep handling system (mobile or fixed), halters and crates)
- personal protective equipment appropriate for species
- livestock weighing scales
- computer ration formulation software.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will articulate arguments concisely and professionally to competently evaluate common production systems, including intensive, extensive and organic systems, giving detailed lines of reasoning for justifications made. Learners will use detailed analysis and research to independently suggest improvements, and assess the advantages and disadvantages for each production system. Learners will include clear examples of how each system impacts on the welfare of the four species of livestock and the breeding of specific animals.

For Merit standard, learners will carefully consider the suitability of livestock production systems, including intensive, extensive and organic systems for the species of farm livestock. They will include why the systems are appropriate for each type of livestock, drawing suitable conclusions. Learners should be independent in their approach, showing that they have used research to extend their understanding to less familiar contexts.

For Pass standard, learners will recall knowledge and understanding to clearly explain intensive, extensive and organic production systems, including the advantages and disadvantages of each system. Learners will explain the differences in breeds of four species of conventional farm livestock and the benefits of keeping those species, considering costs (animals, feed, and equipment), ease of handling, safety and how humans can use breed characteristics to their advantage.

Learning aims B and C

Learners must base this assignment on four different species of livestock. These can be the same livestock considered in learning aim A, or four different species.

Learners must be given a witness statement from a workplace supervisor that describes, in sufficient detail for the assessor to make a judgement, how learners carried out the required skills and techniques. Alternatively, they should be given an assessor observation record that details how the learner carried out the required skills and techniques, and how it met the assessment criteria.

For Distinction standard, learners will show how they used the most appropriate techniques to competently handle and successfully assess the body conditions of four conventional farm livestock species, in order to justify the diets and feeding strategies for the different species. They will show that they can use practical skills in complex situations and that they are capable of performing and evaluating safely while handling livestock, demonstrating safe and correct use of common handling equipment. Learners will also communicate clearly and concisely in a professional discussion, or in a professional manner during the practical assessment.

They will explore the advantages and disadvantages of handling techniques and systems used for the four species being assessed, highlighting areas of concern and referring to health, hygiene and safety of handler and animal. Learners will independently select and evaluate diets and feeding strategies for the four species of farm livestock, making significant and relevant recommendations for improvement to promote higher welfare. Learners will demonstrate an understanding of nutritional requirements, and demonstrate methods and techniques to accurately balance feed rations in at least four animals to meet the required purpose, independently using manual and computer-based ration formulation techniques.

Learners will draw together knowledge and understanding from across the learning aims to evaluate how their use of techniques has contributed to meeting current livestock standards, making suitable justifications and recommendations.

For Merit standard, learners will select and use appropriate techniques to analyse and record feed ingredients for nutritional composition. They will assess the condition of, and competently handle, four species of farm livestock using the correct handling techniques and selection of equipment. Learners will demonstrate and communicate, in a structured and defined way, the advantages and disadvantages of handling techniques and systems used for the four species being assessed. Learners will be able to demonstrate a structured approach to balancing rations for the four animals and an awareness of the nutritional needs for the breed/species.

For Pass standard, learners will practically select and use appropriate routine cleaning and maintenance techniques on animal accommodation for four species of farm livestock species. Learners will work safely and correctly, following protocols given. Learners will accurately demonstrate and communicate, using some technical language, the correct health and safety practices when working with farm livestock to meet current legislative requirements. Learners will recall knowledge to outline the nutritional requirements of four farm livestock species and will correctly balance rations for the given species, recording the information in appropriate ways. Learners will explain the correct feeding and watering equipment needed for four farm livestock species, relating their knowledge to well-defined situations.

Links to other units

This unit links to *Unit 8: Animal Production Systems*.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- opportunities for observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

In completing this unit, learners will have the opportunity to develop a number of transferable employability skills including:

- analytical and decision-making skills
- formal written communication
- working with others safely in hazardous environments
- self-management and planning skills
- ability to work in an environmental, moral and ethical manner.

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Unit 11: International Pig Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills and knowledge needed to carry out routine feeding and husbandry practices to raise pigs successfully in pig production systems.

Unit introduction

Pig production is a large global industry. Successful pig producers have a thorough understanding of the factors affecting both the domestic pig industry and the global market, developing and adapting their husbandry skills in an environment where the market price for pig products is constantly changing.

In this unit, you will investigate different pig production systems for indoor and outdoor pigs, weaner production, rearing and fattening, and the associated pig accommodation. You will carry out routine feeding and husbandry tasks throughout the production cycle as part of management of the breeding and the growing pig. You will find out how production affects animal welfare and develop skills in meeting the nutritional requirements of pigs at different stages in the production cycle, including feed ingredients and ration formulation. You will develop a clear understanding of the legal, economic and environmental factors that contribute to decision making in pig production. This will allow you to make informed decisions in relation to future pig production.

This unit will help you to progress to employment in small- or large-scale pig production units and to general farm work, or to higher-education courses in areas such as animal science, agriculture or agricultural business.

Learning aims

In this unit you will:

A Investigate pig production systems

B Carry out diet management and feeding practices during the production cycle to maintain health and production targets

C Carry out routine husbandry of pigs during the production cycle to meet current welfare and husbandry standards.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate pig production systems	**A1** Pig production systems **A2** Preparation for breeding **A3** Selecting animals for market, end of use and role of performance indicators	A report on a selected pig production system and the production cycle.
B Carry out diet management and feeding practices during the production cycle to maintain health and production targets	**B1** Nutritional requirements **B2** Diet management and feeding practices **B3** Nutritional problems	A portfolio of evidence, to include: • planning documents • evidence of carrying out routine pig feeding and husbandry tasks to meet current standards and health and production targets.
C Carry out routine husbandry of pigs during the production cycle to meet current welfare and husbandry standards	**C1** Routine husbandry **C2** Preparations for pre-farrowing and farrowing	

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Content

Learning aim A: Investigate pig production systems

A1 Pig production systems

Common production systems and associated considerations and processes for each.

- Current national conditions in the pig industry, including pig numbers, range of pig products, current rearing trends, current national and global consumer trends.
- Pig production systems:
  - indoor and outdoor systems for breeding, including intensive, semi-intensive, extensive
  - rearing systems and methods
  - housing systems for breeding
  - growing and finishing stock for indoor and outdoor systems.
- Factors affecting choice of production system, including financial, economic, marketing, availability of services, current farming practices, environmental factors and current legislative requirements.
- Liveweight and deadweight selling.
- Carcass classification and grading, e.g. for use in processed products.
- Pig breeds, hybrids, genotype and genetics and their suitability in different production systems.
- Site requirements for outdoor pig units, including climate, soil type, topography.
- Biosecurity measures in pig production, including disinfectant foot dips, lorry wheel wash.
- Environmental impact and pollution control.
- Other factors associated with biosecurity measures, including health and safety, biosecurity levels, movement and transport of pigs, pest and vermin control, feeding, water and bedding, people, equipment.
- Legislation and welfare standards in key aspects of pig production, including:
  - culling
  - husbandry
  - sustainability.
- Welfare requirements associated with:
  - farrowing crates
  - group pens
  - indoor pig rearing
  - slatted floors
  - tooth clipping
  - castration
  - physiological and psychological stress.

A2 Preparation for breeding

Suitable selection of animals to meet production aims and welfare standards.

- Selection of suitable stock for breeding in line with breeding policy:
  - breeding stock selection of boars, sows and gilts
  - interpretation of secondary breeding data
  - use of selection programmes in livestock improvement.
- Use of reproductive technologies, including artificial insemination, sexed semen.
- Preparation for breeding in line with breeding policy, including:
  - assessment and evaluation of the boar, sow and gilt
  - health checking of individual animals
  - body condition scoring/mobility scoring
  - behavioural assessment of groups and individual animals
  - identification of ovulation, including oestrus cycle and role of hormones, heat observation, optimum time for service
  - andrology and sperm analysis, principles and application
  - artificial manipulation of the oestrus cycle
  - pregnancy diagnosis, including visual methods, use of technology
  - complying with health and safety and welfare requirements during preparation for breeding.

A3 Selecting animals for market, end of use and role of performance indicators

- Selection of stock for sale, including:
  - grading of finished animals
  - saleability factors
  - selection factors and preparation of animals for market or slaughter
  - current, relevant regulations regarding preparation of animals for market or slaughter, including those governing the transport of livestock, completion of movement records, health and safety, animal welfare.
- Performance indicators, including calculation of relevant performance indicators (piglet percentage, mortality rates, financial indicators, productivity).

Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets

B1 Nutritional requirements

- Nutritional requirements for breeding animals at the various stages of the production cycle, including pre-service, mid and late pregnancy, farrowing, lactation.
- Formulation of rations for pregnant sows/gilts to meet target growth rates.
- Importance of protein and lysine in pig diets.
- Nutritional requirements of newborn piglets through to finishing.
- Types of feed, including concentrates, grains and supplemental feeding of root crops.

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B2 Diet management and feeding practices

- Feeding systems, including wet and dry feed systems.
- Types of feeding and watering equipment, including nipple feeder, bottles, creep feeders, water delivery systems.
- Cleaning and maintenance of feeding and watering equipment.
- Assessment of basic feed quality for suitability, including adverse effects of inadequate and prohibited feed ingredients and toxins.
- Facilities for feed storage to maintain quality.
- Recording systems, including feed boards, databases and online recording systems.
- Weight gain and maintenance at each life stage.

B3 Nutritional problems

- Possible signs of a nutritional problem, including poor appetite, reduced growth and lethargy.
- Common nutritional health issues, including specific nutrient deficiencies, excesses, parasitism and disorders.
- Causes, treatment and prevention of nutritional problems.

Learning aim C: Carry out routine husbandry of pigs during the production cycle to meet current welfare and husbandry standards

C1 Routine husbandry

- Routine husbandry to maintain health:
  - feeding and watering
  - routine checks of health, disease diagnoses, heat detection
  - unit hygiene, including cleanliness, tidiness, disinfectant use
  - maintenance of housing, including cleaning out, bedding down
  - signs of normal and abnormal health, including health checking, actions to prevent decline of health status and when to seek veterinary assistance
  - role of veterinary medicines in treating and controlling disease
  - responsible use of veterinary medicines under the regulations set out by the Veterinary Medicines Directorate (VMD), including measures to prevent or control exposure, reading the label and data sheets, engineered controls, competence and training requirements
  - record keeping, including veterinary medicines book, record of births and deaths and husbandry records
  - isolation of replacement stock
  - government requirements for movement documentation and standstill
  - health and safety and risk assessments, use of personal protective equipment (PPE).
- Routine husbandry associated with breeding pigs:
  - assisting at farrowing
  - serving animals
  - administering of veterinary and medical products
  - animal health planning and monitoring.

- Routine husbandry associated with growing pigs:
  - teeth clipping, tail docking, injecting and weighing
  - data recording and assessment, including physical, financial, movement licences, veterinary and medical, herd performance, sales invoices
  - reasons for records, including legal, operational, managerial.

C2 Preparations for pre-farrowing and farrowing

Preparations for pre-farrowing and farrowing:

- stages of pre-farrowing, including approximate timings
- indicators for farrowing and inducing labour
- feeding programme planning, including planned weight gains and quantities
- common bacterial, viral and parasitic diseases, including erysipelas, scour
- disease diagnoses, prevention and treatment in breeding pigs
- movement of animals into farrowing pen/crate
- assessment of animal's health and welfare, including good and poor health indicators
- farrowing problems, including large litters, rotation in womb, failure of cervix to open, dead piglets in womb, sow illness
- care of the newborn piglets.

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Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate pig production systems		
A.P1 Explain a production system for breeding pigs. **A.P2** Demonstrate competent selection of animals for market and end of use, using performance indicators.	**A.M1** Analyse the impact of pig production and accurate selection on overall performance and production outcomes. **A.M2** Demonstrate effective selection of animals for market and end of use, using performance indicators.	**A.D1** Demonstrate proficient selection of animals for market and end of use, evaluating the impact of a pig production system and accurate selection on overall production outcomes.
Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets		
B.P3 Explain the importance of diet management and feeding practices throughout the pig production cycle. **B.P4** Demonstrate competent feeding and diet management of pigs to maintain health and production targets.	**B.M3** Analyse the impact that nutrition, diet management and feeding practices have on health and production targets. **B.M4** Demonstrate efficient feeding and diet management of pigs to maintain health and production targets.	**B.D2** Demonstrate, with a high degree of accuracy, diet management and feeding of pigs to maintain health and production targets, evaluating the impact of nutrition and own feeding and diet management tasks.
Learning aim C: Carry out routine husbandry of pigs during the production cycle to meet current welfare and husbandry standards		**C.D3** Demonstrate, with a high degree of accuracy, routine husbandry of pigs to maintain health and production targets and meet requirements during pre-farrowing and farrowing.
C.P5 Demonstrate competent routine husbandry of pigs to meet health and production targets. **C.P6** Demonstrate competent routine husbandry required during pre-farrowing and farrowing.	**C.M5** Demonstrate efficient routine husbandry of pigs to maintain health and production targets and meet requirements during pre-farrowing and farrowing.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M3, B.M4, C.M5, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- commercial pig production units
- pigs at the centre
- specific equipment used in handling, restraints and routine husbandry
- markets/abattoirs to visit.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give an in-depth review of one pig production system with specific breeds, thoroughly considering breed suitability and how accurate selection of stock affects overall production outcomes. They will make comprehensive, accurate connections between key factors within the production system and the requirements to select the most suitable breed to meet production targets. Learners will comprehensively review secondary information on the selected production method, with a robust evaluation of the advantages and disadvantages, and logical justifications regarding the most suitable breeds. They will show depth of understanding to identify accurately those animals ready for market and end of use, giving valid, well-reasoned justifications for their views. Learners will show breadth and depth of understanding of performance indicators as a measure of success and the implications for health and welfare, using specific agricultural terminology accurately throughout. Learners will consistently recommend relevant, insightful strategies to improve animal welfare in the production cycle.

For Merit standard, learners will make relevant, analytical judgements on one pig production system with specific breeds and on overall production outcomes. They will make mainly relevant connections between the different aspects of the production system and the requirements to select the most suitable breed to meet production targets. Learners will provide a clear review of secondary information on the selected production method, with a clear analysis of the advantages and disadvantages. They will give mostly valid justifications for their choice of the most suitable breeds. They will show breadth and some depth of understanding when identifying those animals ready for market and end of use, giving mostly valid justifications for their views. Learners will show breadth and some depth of understanding of performance indicators as a measure of success and the implications for health and welfare. The evidence will use specific, accurate terminology. Learners will, at all times, show relevant and realistic consideration of animal welfare in the production cycle, making mostly relevant recommendations for improvements.

For Pass standard, learners will give a limited, realistic account of one pig production system with specific breeds and the most obvious factors that affect the selection of pigs for market and end of use. They will show a basic understanding of how correct selection affects overall production targets, making basic connections between the key factors within the production system and the requirements for selecting the most suitable breed to meet production targets. Learners will use some secondary information on the chosen production method to identify the advantages and disadvantages, giving basic explanations for their choice of the most suitable breeds.

They will recall knowledge to identify those animals ready for market and end of use but will not provide justifications for their views. Learners will show limited breadth and depth of understanding of performance indicators as a measure of success and the implications for health and welfare, using some relevant terminology. Learners will, at all times, consider animal welfare in the production cycle, identifying basic changes that could be made.

Learning aims B and C

In order to achieve learning aims B and C, learners must demonstrate the required knowledge and skills within the context of a chosen pig production system. Teachers should ensure that the pig production system selected by learners provides sufficient scope for them to fully complete the assessments.

For Distinction standard, learners will demonstrate the practical skills required to care for a production herd and individual animals during pre-farrowing and farrowing to a standard that reflects best practice in the workplace. They will carry out all the practical tasks confidently, showing a high degree of initiative within the limits of their responsibility.

Learners will evidence insightful strategies to minimise risks, demonstrating proficient safe working practices throughout. They will select the correct equipment, using it safely and accurately. They will ensure that animal welfare is maintained effectively and disruption to the animals is minimised. Learners will demonstrate proficiency in complying with biosecurity policies and procedures. They will show depth of understanding of the activities affected by biosecurity, how to take action to prevent non-compliance, and the consequences of biosecurity breaches. They will keep detailed and accurate records as appropriate to the tasks being carried out.

Learners will carry out feeding and diet management with a high degree of accuracy, ensuring the required foodstuffs are available and prepared, and informing others if there are problems. They will show depth of understanding of the importance of diet management within a pig production system through a detailed review of nutritional requirements, feeding practices and common nutritional problems (causes, treatments and prevention), with well-reasoned recommendations for improvement.

Learners will carry out routine husbandry activities with boars, sows, gilts and piglets, demonstrating a robust understanding of the practices used to care for the animals. They will make convincing connections between good husbandry and healthy pigs. Learners will show in-depth understanding of the importance of animal welfare and the need to review and maintain it as part of normal operation. They will show clear understanding that recognising and dealing with ill health in livestock is part of routine husbandry, demonstrating this when carrying out their activities. Learners will recognise the common signs of ill health in pigs, showing accurate knowledge of how to treat common diseases and disorders. They will review their approaches to carrying out routine husbandry activities, feeding and diet management in terms of their effectiveness in maintaining good health and hygiene of livestock. Learners will explore thoroughly where they were successful and where approaches could be improved or carried out differently.

Learners' evidence will use specific, accurate terminology throughout.

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For Merit standard, learners will demonstrate the practical skills required to care efficiently and safely for a production herd and individual animals during pre-farrowing and farrowing. They will carry out the practical tasks competently and show some initiative within the limits of their responsibility. Learners will show efficient use of time and resources, and meet the key requirements for animal welfare. They will assess the risks and hazards, using the required equipment safely and competently. Learners will demonstrate competency in complying with biosecurity policies and procedures. They will show clear understanding of most of the activities that are affected by biosecurity and how to take action to prevent non-compliance. Learners will keep records, as appropriate to the tasks and with sufficient detail, so it is clear what has been carried out.

Learners will carry out feeding and diet management correctly, making efficient use of resources, and with some preparation of foodstuffs. They will show a clear understanding of the importance of diet management within a pig production system through providing details of nutritional requirements, feeding practices and common nutritional problems (causes, treatments and prevention), making mostly valid recommendations for improvement.

Learners will competently carry out routine husbandry activities with boars, sows, gilts and piglets, demonstrating sound understanding of the practices used to care for the animals and making relevant connections between good husbandry and healthy pigs. They will demonstrate a clear understanding of the importance of animal welfare and the need to maintain it as part of normal operation. Learners will show understanding that recognising and dealing with ill health in livestock is part of routine husbandry and will demonstrate this when carrying out some of their activities, but there may be some minor omissions. They will recognise the common signs of ill health in pigs and show some knowledge of how to treat common diseases and disorders. Learners will reflect on the approaches they used, making clear connections to their impact on the good health and hygiene of livestock, with mainly relevant recommendations for improvement.

Learners' evidence will use specific, appropriate technical terminology.

For Pass standard, learners will demonstrate the practical skills required to care for a production herd and individual animals during pre-farrowing and farrowing safely and competently. They will carry out the practical tasks appropriately, showing little initiative within the limits of their responsibility.

Learners will work safely, with a realistic, limited awareness of the risks and potential issues arising when carrying out routine feeding and husbandry in a pig production system. They will use the appropriate equipment and leave the area clean and tidy on completion. Learners will show a realistic awareness of the importance of complying with biosecurity policies and procedures. They will recall knowledge of most activities that are affected by biosecurity and outline actions to prevent non-compliance. Learners will show an awareness of the need to keep appropriate records, providing the key information.

Learners will carry out feeding and diet management safely and competently, demonstrating a realistic, limited awareness of the importance of minimising wastage of resources. They will show basic understanding of the significance of the role of feeding and diet management in the production cycle. Learners will recall basic knowledge to explain the nutritional requirements, feeding practices and common nutritional problems (causes, treatments and prevention) for a pig production system.

Learners will carry out routine husbandry activities with boars, sows, gilts and piglets, demonstrating some relevant understanding of the practices used to care for the animals. They will carry out routine care and identify tasks to be completed in a generally appropriate order. Learners will make basic, realistic links between good husbandry and healthy pigs. They will show an appropriate awareness of how to maintain the welfare of animals as part of normal operation and the need to maintain it at all times. Learners will show a realistic awareness that recognising and dealing with ill health in livestock is part of routine husbandry, demonstrating this when carrying out some of their activities, but this will be limited. They will identify the common signs of ill health in pigs and show limited knowledge of how to treat common diseases and disorders. Learners will demonstrate a realistic but undeveloped understanding of how the approaches they used link to the good health and hygiene of livestock.

Learners' evidence will use some relevant terminology but there may be omissions.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 10: Farm Livestock Husbandry
- Unit 15: Livestock Health and Diseases
- Unit 16: Livestock Nutrition.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- reflective practices when considering an animal production brief
- practical application when reflecting on an animal care
- safe working practices and procedures in the exploration of land-based machinery.

Unit 12: International Sheep Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners will develop the skills and knowledge needed to carry out feeding and husbandry practices to raise sheep successfully in sheep production systems.

Unit introduction

Sheep production uses many different breeds of sheep. Sheep farming takes place under extensive systems in the uplands and plays an important role in managing the environment and supporting the rural economy. In lowland areas, sheep are farmed more intensively, producing finished lamb for the market and breeding stock. Successful sheep producers have a thorough understanding of the factors affecting both the domestic sheep industry and the global market, developing and adapting their husbandry skills in an environment where the market price for sheep products is constantly changing.

In this unit, you will investigate different sheep production systems for hill, upland and lowland sheep, the regulations governing the transportation of livestock, and the need to record medicine usage and all tasks and treatments carried out. You will carry out routine feeding and husbandry tasks throughout the production cycle as part of the management of breeding lambs and newborn lambs, including making up a flock and preparations for tupping, and managing a flock through to lambing. You will find out how production affects animal welfare and develop skills in meeting the nutritional requirements of sheep at different stages in the production cycle, including feed ingredients and ration formulation. You will develop a clear understanding of the legal, economic and environmental factors that contribute to decision making in sheep production. This will allow you to make informed decision in relation to future sheep production.

This unit will help you to progress to employment in the sector at peak times of the year, such as in the lambing seasons, and to higher-education courses in agriculture, agricultural business or animal science.

Learning aims

In this unit you will:

A Investigate sheep production systems

B Carry out diet management and feeding practices during the production cycle to maintain health and production targets

C Carry out routine husbandry of sheep during the production cycle to meet current welfare and husbandry standards.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate sheep production systems	**A1** Sheep production systems **A2** Preparation for breeding **A3** Selecting animals for market and the role of performance indicators	A report on a selected sheep production system and the production cycle.
B Carry out diet management and feeding practices during the production cycle to maintain health and production targets	**B1** Nutritional requirements **B2** Diet management and feeding practices **B3** Grazing **B4** Nutritional problems	A portfolio of evidence, to include: • planning documents • evidence of carrying out routine sheep feeding and husbandry tasks to meet current standards and health and production targets.
C Carry out routine husbandry of sheep during the production cycle to meet current welfare and husbandry standards	**C1** Routine husbandry **C2** Preparations for pre-lambing and lambing **C3** Care of the newborn lamb	

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Content

Learning aim A: Investigate sheep production systems

A1 Sheep production systems

Common production systems and associated considerations and processes for each.

- Current national conditions in the sheep industry, including sheep numbers, range of sheep products, current rearing trends, current national and global consumer trends.
- Sheep production systems:
  - stratification of the sheep industry in a sheep-producing country, including hill, upland and lowland
  - extensive production systems.
- Factors affecting choice of production system, including financial, economic, marketing, availability of services, current farming practices, environmental factors and current legislative requirements.
- Liveweight and deadweight selling.
- Carcass classification and grading, e.g. for use in processed products.
- Sheep breeds, hybrids, genotype and genetics and their suitability in different production systems.
- Suitability of a field for sheep, including fencing, grazing availability and access.
- Biosecurity measures in sheep production, including disinfectant foot dips, lorry wheel wash.
- Environmental impact and pollution control.
- Other factors associated with biosecurity measures, including health and safety, biosecurity levels, movement and transport of sheep, pest and vermin control, feeding, water and bedding, people, equipment.
- Legislation and welfare standards in key aspects of sheep production including:
  - culling
  - husbandry
  - sustainability
  - transport.
- Welfare requirements associated with:
  - castration
  - tail docking
  - mulesing
  - lambing stress on ewes
  - environmental stresses and transportation.

A2 Preparation for breeding

Suitable selection of animals to meet production aims and welfare standards.

- Selection of suitable stock for breeding in line with breeding policy:
  - breeding stock selection of rams and ewes
  - interpretation of secondary breeding data
  - use of selection programmes in flock improvement
  - breed comparisons for use in different production systems
  - hill, upland and lowland breeds and the environmental adaptations.

- Preparation for breeding in line with breeding policy, including:
  - assessment and evaluation of the ram and ewe
  - health checking of flock and individual animals
  - body condition scoring
  - behavioural assessment of flock and individual animals
  - identification of ovulation, including oestrus cycle and role of hormones, heat observation, optimum time for service
  - pregnancy diagnosis, including visual methods, use of technology
  - andrology and sperm analysis, principles and application
  - complying with health and safety and welfare requirements during preparation for breeding.

A3 Selecting animals for market and the role of performance indicators

- Selection of stock for sale, including:
  - assessment of animals, including grading of finished animals, weight and body condition scores
  - saleability factors, including fat coverage
  - selection factors and preparation of animals for market or slaughter
  - current, relevant regulations, including those governing the transport of livestock, completion of movement records, health and safety, animal welfare.
- Performance indicators, including calculation of relevant performance indicators (lambing percentage, lamb mortality, financial indicators).

Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets

B1 Nutritional requirements

- Nutritional requirements of the flock at the various stages of the production cycle, including pre-tupping, tupping, mid and late pregnancy, lambing, lactation.
- Nutritional requirements of newborn lambs through to finishing.
- Types of feed, including forages, concentrates and supplemental feeding of root crops.
- Weaning to breeding of ewes for increased twinning rates, including daily gains, rate of gain.
- Rations for pregnant ewes up to six weeks before lambing and for finisher lambs to meet target growth rates.

B2 Diet management and feeding practices

- Types of feeding and watering equipment, including nipple feeder, bottles, creep feeders, hay feeding devices, water delivery systems.
- Cleaning and maintenance of feeding and watering equipment.
- Feeding lambs on milk replacers.
- Assessment of basic forage quality for suitability as feed, using standard criteria.
- Diet plans for individuals and flock.
- Recording systems, including feed boards, databases and online recording systems.
- Facilities for feed storage to maintain quality.
- Weight gain and maintenance at each life stage.

B3 Grazing

- Assessment of grazing suitability for sheep, including continuous and rotational systems.
- Grazing preferences in sheep and impact on species diversity.
- Differences in grazing habits of hill, upland and lowland sheep.

B4 Nutritional problems

- Possible signs of a nutritional problem, including poor appetite, reduced growth and lethargy.
- Common nutritional health issues, including specific nutrient deficiencies, excesses, parasitism and disorders.
- Causes, treatment and prevention of nutritional problems.

Learning aim C: Carry out routine husbandry of sheep during the production cycle to meet current welfare and husbandry standards

C1 Routine husbandry

Routine husbandry to maintain a healthy flock and ensure high levels of animal welfare.

- Routine husbandry:
  - feeding and watering
  - routine health and welfare checks and audits, including:
    - checking and trimming feet, including hoof structure
    - treating lameness, including foot dips, medicated sprays and internal treatments
  - dagging ewes and lambs
  - ear tagging ewes or lambs
  - vaccinating sheep
  - maintenance of housing, including cleaning out, bedding down
  - unit hygiene, including cleanliness, tidiness, appropriate disinfectant use
  - specific signs of normal and abnormal health, including health checking, actions to prevent decline of health status and when to seek veterinary assistance
  - role of veterinary medicines in treating and controlling disease
  - the need for responsible use of veterinary medicines under the regulations set out by the Veterinary Medicines Directorate (VMD), including measures to prevent or control exposure, reading the label and data sheets, engineered controls, competence and training requirements
  - record keeping, including veterinary medicines book, record of births and deaths and husbandry records
  - isolation of replacement stock
  - government requirements for movement documentation and standstill
  - health and safety and risk assessments, use of personal protective equipment (PPE).

C2 Preparations for pre-lambing and lambing

Preparations for pre-lambing and lambing, including:

- feeding programme planning, including planned weight gains and quantities
- feeding methods for a flock of in-lamb ewes
- methods of preventing abortion and dealing with aborting ewes
- identifying ewes that need assistance
- identifying and preventing metabolic problems in ewes
- scanning and marking
- assessment of animal health and welfare, including indicators of good and bad health.

C3 Care of the newborn lamb

Maintaining high levels of animal welfare in accordance with legislative requirements and best practice.

- Care of the newborn lamb to ensure high welfare and maximise survival:
  - importance of adequate colostrum
  - navel treatments to prevent infection
  - use of probiotics and prebiotics in newborns
  - tail docking, including correct procedure, elastrator and reasons for not docking
  - methods of non-surgical castration of lambs
  - feeding lambs using a stomach tube to improve survival
  - taking the temperature of lambs correctly
  - fostering lambs and techniques for dealing with rejection by the ewe.
- Common problems, treatments and prevention, including lethargy, unwillingness to search for the teat and suck, profuse salivation, increasing abdominal distension and retained meconium (watery mouth), rejection of the lamb by the ewe, hypothermia and umbilical infection.
- Disease prevention in lambs during the first few weeks of life, including good hygiene practices across the farm.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate sheep production systems		**A.D1** Demonstrate proficient selection of animals for market and end of use, evaluating the impact of a sheep production system and accurate selection on overall production outcomes.
A.P1 Explain a production system for sheep. **A.P2** Demonstrate competent selection of animals for different markets and end of use, using performance indicators.	**A.M1** Analyse the impact of a sheep production system and accurate selection on overall performance and production outcomes. **A.M2** Demonstrate effective selection of animals for different markets and end of use.	
Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets		**B.D2** Demonstrate, with a high degree of accuracy, diet and grazing management of sheep to maintain health and production targets, evaluating the impact of nutrition and diet and grazing management tasks.
B.P3 Explain the importance of diet management and feeding practices throughout the sheep production cycle. **B.P4** Demonstrate competent diet and grazing management of sheep to maintain health and production targets.	**B.M3** Analyse the impact that nutrition, diet and feeding management have on health and production targets. **B.M4** Demonstrate efficient diet and grazing management of sheep to maintain health and production targets.	
Learning aim C: Carry out routine husbandry of sheep during the production cycle to meet current welfare and husbandry standards		**C.D3** Demonstrate, with a high degree of accuracy, routine husbandry of sheep to maintain health and production objectives and meet requirements during pre-lambing and lambing.
C.P5 Demonstrate competent routine husbandry of sheep to meet health and production targets. **C.P6** Carry out competent routine husbandry required for pre-lambing and lambing.	**C.M5** Demonstrate efficient routine husbandry of sheep to maintain health and production targets and meet requirements during pre-lambing and lambing.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M3, B.M4, C.M5, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- commercial sheep production farms
- relevant husbandry equipment
- sheep at the centre
- markets/abattoirs to visit.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give an in-depth review of one common sheep production system with specific breeds, thoroughly considering breed suitability and how accurate selection for at least three different markets, such as breeding stock, fat lambs and store lambs, affects overall production outcomes. They will make comprehensive, accurate connections between key factors within the production system and the requirements to select the most suitable breed to meet production targets. Learners will comprehensively review secondary information on the selected production method, with a robust evaluation of the advantages and disadvantages, and logical justifications regarding the most suitable breeds. They will show depth of understanding to correctly identify those animals ready for market and end of use, giving valid, well-reasoned justifications for their views. Learners will show breadth and depth of understanding of performance indicators as a measure of success and the implications for health and welfare, using specific terminology appropriately throughout. Learners will consistently recommend relevant, insightful strategies to improve animal welfare in the production cycle.

For Merit standard, learners will make relevant, analytical judgements on one sheep production system, breed suitability and on overall production outcomes. They will make mainly relevant connections between the different aspects of the production system and the requirements to select the most suitable breed to meet production targets. Learners will provide a clear review of secondary information on the selected production method, with a clear analysis of the advantages and disadvantages, and giving mostly relevant justifications for their choice of the most suitable breeds. They will show breadth and some depth of understanding when identifying those animals ready for market and end of use, giving mostly valid justifications for their views. Learners will show breadth and some depth of knowledge and understanding of performance indicators as a measure of success and the implications for health and welfare. The evidence will use specific, accurate terminology. Learners will, at all times, show relevant and realistic consideration of animal welfare in the production cycle, making mostly relevant recommendations for improvements.

For Pass standard, learners will give a limited, realistic account of one sheep production system and the most obvious factors that affect the selection of sheep for market. They will show a basic understanding of how correct selection affects overall production targets, making basic connections between the key factors within the production systems and the requirements for selecting the most suitable breed to meet production targets. Learners will use some secondary information on the chosen production

method to identify some relevant advantages and disadvantages, giving basic explanations for their choice of the most suitable breeds. They will recall knowledge to identify those animals ready for market and end of use but will not provide justifications for their views. Learners will show limited breadth and depth of understanding of performance indicators as a measure of success and the implications for health and welfare, using some relevant terminology. Learners will, at all times, consider animal welfare in the production cycle, identifying basic changes that could be made.

Learning aims B and C

In order to achieve learning aims B and C, learners must demonstrate the required knowledge and skills within the context of a chosen sheep production system. Teachers should ensure that the sheep production system selected by learners provides sufficient scope for them to fully complete the assessments.

For Distinction standard, learners will demonstrate the practical skills required to care for a production flock to a standard that reflects best practice in the workplace. They will carry out all the practical tasks confidently, showing a high degree of initiative within the limits of their responsibility.

Learners will evidence insightful strategies used to minimise risks, demonstrating proficient safe working practices throughout. They will select the correct equipment, using it safely and accurately. They will ensure that animal welfare is maintained effectively and disruption to the animals is minimised. Learners will demonstrate proficiency in complying with biosecurity policies and procedures. They will show depth of understanding of the activities affected by biosecurity, how to take action to prevent non-compliance, and the consequences of biosecurity breaches. They will keep detailed and accurate records as appropriate to the tasks being carried out.

Learners will carry out feeding and diet management with a high degree of accuracy, ensuring the required foodstuffs are available and prepared, and informing others if there are problems. They will demonstrate depth of understanding of the importance of diet management within a sheep production system through a detailed review of feeding and diet plans and the need for grazing management for the flock at different life stages, with well-reasoned recommendations for improvement.

Learners will carry out routine husbandry activities with the flock, from carrying out preparations required for pre-lambing and lambing in a production system through to caring for young stock. They will demonstrate a robust understanding of the practices used to care for the animals. Learners will make convincing connections between good husbandry and healthy sheep. They will show in-depth understanding of the importance of animal welfare and the need to review and maintain it as part of normal operation. They will show clear understanding that recognising and dealing with ill health in livestock is part of routine husbandry and will demonstrate this when carrying out their activities. Learners will recognise the common signs of ill health in sheep, showing accurate knowledge of how to treat common diseases and disorders. They will review their approaches to carrying out routine husbandry activities and feeding and diet management in terms of their effectiveness in maintaining good health and hygiene of livestock. Learners will explore thoroughly where they were successful and where approaches could be improved or carried out differently.

Learners' evidence will use specific, accurate terminology throughout.

For Merit standard, learners will demonstrate the practical skills required to care efficiently and safely for a production flock. They will carry out the practical tasks competently and show some initiative within the limits of their responsibility. Learners will show efficient use of time and resources, and meet the key requirements for animal welfare. They will assess the risks and hazards, using the required equipment safely and competently. Learners will demonstrate competency in complying with biosecurity policies and procedures. They will show clear understanding of most activities that are affected by biosecurity and how to take action to prevent non-compliance. Learners will keep records, as appropriate to the tasks and with sufficient detail, so it is clear what has been carried out.

Learners will carry out feeding and diet management correctly, making efficient use of resources, and with some preparation of foodstuffs. They will show a clear understanding of the importance of diet management within a sheep production system through providing details of feeding and diet plans and the need for grazing management for the flock at different life stages, making mostly valid recommendations for improvement.

Learners will competently carry out routine husbandry activities with the flock, from carrying out preparations required for pre-lambing and lambing in a production system through to caring for young stock. They will demonstrate sound understanding of the practices used to care for the animals and make relevant connections between good husbandry and healthy sheep. Learners will demonstrate a clear understanding of the importance of animal welfare and the need to maintain it as part of normal operation. They will understand that recognising and dealing with ill health in livestock is part of routine husbandry and will demonstrate this when carrying out some of their activities, but there may be some minor omissions. Learners will recognise the common signs of ill health in sheep and show some knowledge of how to treat common diseases and disorders. Learners will reflect on the approaches they used, making clear connections to their impact on the good health and hygiene of livestock, with mainly relevant recommendations for improvement.

Learners will use specific, appropriate technical terminology.

For Pass standard, learners will demonstrate the practical skills required to care for a production flock safely and competently. They will carry out the practical tasks appropriately, showing little initiative within the limits of their responsibility.

Learners will work safely, with a realistic but limited awareness of the risks and potential issues arising when carrying out routine feeding and husbandry in a sheep production system. They will use the appropriate equipment and leave the area clean and tidy on completion. Learners will show a realistic awareness of the importance of complying with biosecurity policies and procedures. They will recall knowledge of most activities that are affected by biosecurity and outline actions to prevent non-compliance. Learners will show an awareness of the need to keep appropriate records, providing the key information.

Learners will carry out feeding and diet management safely and competently, demonstrating a realistic, limited awareness of the need to ensure minimal wastage of resources. They will show basic understanding of the significance of the role of feeding and diet management in the production cycle. Learners will recall basic knowledge to explain the nutritional requirements, feeding practices and grazing management for the flock at different life stages for a sheep production system.

Learners will carry out routine husbandry activities, from basic preparations required for pre-lambing and lambing in a production system through to caring for young stock. They will demonstrate some relevant understanding of the practices used to care for the animals. Learners will carry out routine care, with some supervision, and identify tasks to be completed in a generally appropriate order. They will make basic, realistic links between good husbandry and healthy sheep. Learners will show an appropriate awareness of the importance of animal welfare as part of normal operation and the need to maintain it at all times. They will show a realistic awareness that recognising and dealing with ill health in livestock is part of routine husbandry, demonstrating this when carrying out some of their activities, but this will be limited. Learners will identify the common signs of ill health in sheep and show limited knowledge of how to treat common diseases and disorders. Learners will demonstrate a realistic but undeveloped understanding of how the approaches they used link to the good health and hygiene of livestock.

Learners' evidence will use relevant terminology but there may be omissions.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 10: Farm Livestock Husbandry
- Unit 15: Livestock Health and Diseases
- Unit 16: Livestock Nutrition.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research and analysis skills
- evaluative and developmental skills
- practical application when providing nutrition to animals
- safe working practices and procedures when working in land-based environments.

Unit 13: International Beef Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills and knowledge needed to carry out feeding and husbandry practices to raise cattle successfully in beef production systems.

Unit introduction

The beef industry often derives its product from both the suckler herds and the dairy herds, all bred in specific production systems. Most beef systems usually require a significant amount of working capital and, therefore, attention to all management aspects is a prerequisite for generation of profits. Successful beef producers have a thorough understanding of the factors affecting both the domestic beef industry and the global market, developing and adapting their husbandry skills in an environment where the market price for beef products is constantly changing.

In this unit, you will investigate the types of production system used in a beef-producing country, and the process of breeding and rearing animals for beef and associated products. You will explore the different breeds and their production characteristics, and the importance of selecting suitable breeds. You will carry out routine feeding and husbandry tasks throughout the production cycle as part of the management of calves and adult animals. You will find out how production affects animal welfare and develop skills in meeting the nutritional requirements of cattle at different stages in the production cycle, including feed ingredients and ration formulation. You will develop a clear understanding of the legal, economic and environmental factors, health and safety and welfare legislation that contribute to decision making in beef production. This will allow you to make informed decisions in relation to future beef production.

This unit will help you to progress to employment in small- or large-scale beef production units and to general farm work, or to higher-education courses in areas such as animal science, agriculture or agricultural business.

Learning aims

In this unit you will:

A Investigate beef production systems

B Carry out diet management and feeding practices during the production cycle to maintain health and production targets

C Carry out routine husbandry of cattle during the production cycle to meet current welfare and husbandry standards.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate beef production systems	**A1** Beef production systems **A2** Preparation for breeding **A3** Selecting animals for sale, end of use and the role of performance indicators	A report on a selected beef production system and the production cycle.
B Carry out diet management and feeding practices during the production cycle to maintain health and production targets	**B1** Nutritional requirements **B2** Diet management and feeding practices **B3** Grazing **B4** Nutritional problems	A portfolio of evidence, to include: • planning documents • evidence of carrying out routine beef cattle feeding and husbandry tasks to meet current standards and health and production targets.
C Carry out routine husbandry of cattle during the production cycle to meet current welfare and husbandry standards	**C1** Routine husbandry **C2** Care of calves	

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Content

Learning aim A: Investigate beef production systems

A1 Beef production systems

Common national production systems and associated considerations and processes for each.

- Current national conditions in the beef industry, including current beef cattle numbers, range of beef products, current national and global consumer trends.
- Beef production systems:
  - intensive, including cereal beef
  - semi-intensive, including silage beef, 18–24 month, store systems
  - extensive, including suckler beef.
- Targets for systems, including growth rates, daily liveweight gain (DLWG), finishing weight, food conversion.
- Factors affecting choice of production system, including financial, economic, marketing, availability of services, current farming practices, environmental factors, current legislative requirements and market requirements.
- Liveweight and deadweight selling.
- Carcass classification and grading, e.g. for use in processed products.
- Beef breeds and characteristics:
  - native and continental breeds
  - beef terminology, including entire, steer, store, conformation, hybrid, polled, killing-out percentage (KO%) %, marbling
  - early and late maturity
  - characteristics of growth, including effect of sex
  - meat cuts in the animal.
- Biosecurity measures in beef production, including disinfectant foot dips, lorry wheel wash.
- Environmental impact and pollution control.
- Other factors associated with biosecurity measures, including health and safety, biosecurity levels, movement and transport of cattle, pest and vermin control, feeding, water and bedding, people, equipment, tuberculosis, notifiable diseases, e.g. foot and mouth.
- Legislation and welfare standards in key aspects of beef production, including:
  - housing and handling systems
  - culling
  - husbandry
  - sustainability.
- Welfare requirements associated with:
  - fully-slatted floors
  - lighting and ventilation
  - space
  - poor hygiene
  - nutrition
  - lack of pain management
  - physiological and psychological stress
  - health problems associated with beef systems.

A2 Preparation for breeding

- Suitable selection of animals to meet production aims and welfare standards.
- Selection of suitable stock for breeding in line with breeding policy:
  - breeding stock selection of bulls and cows, including scrotal circumference and use of Estimated Breeding Values (EBVs)
  - interpretation of breeding data
  - use of selection programmes in herd improvement.
- Use of reproductive technologies, including artificial insemination, sexed semen.
- Preparation for breeding in line with breeding policy, including:
  - assessment and evaluation of the bull and cow
  - health checking of herd and individual animals
  - body condition scoring and mobility scoring of individual animals
  - behavioural assessment of individual animals
  - identification of ovulation, including oestrus cycle and role of hormones
  - pregnancy diagnosis, including visual methods, use of technology
  - andrology and sperm analysis, principles and application
  - pregnancy diagnosis, including heat detection
  - compact calving and artificial manipulation of the oestrus cycle
  - complying with health and safety and welfare requirements during preparation for breeding.

A3 Selecting animals for sale, end of use and the role of performance indicators

- Selection of stock for sale, including:
  - assessment of animals, including grading of finished animals, weight and body condition scores
  - saleability factors, including fat coverage
  - selection factors and preparation of animals for market or slaughter
  - current, relevant regulations, including those governing the transport of livestock, completion of movement records, health and safety, animal welfare.
- Performance indicators, including calculation of relevant performance indicators (calving percentage, mortality rates, financial indicators, productivity).

Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets

B1 Nutritional requirements

- Nutritional requirements for breeding animals at the various stages of the production cycle, including pre-service, mid and late pregnancy, calving, lactation.
- Nutritional requirements of newborn calves through to finishing.
- Types of feed, including forages, concentrates and supplemental feeding of root crops.
- Formulate rations for pregnant cows and rations to meet target growth rates for calves.

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B2 Diet management and feeding practices

- Feeding techniques, including restricted feeding, ad libitum, creep feeding.
- Types of feeding and watering equipment, including nipple feeder, bottles, creep feeders, racks, mangers, water delivery systems, mixer wagons.
- Cleaning and maintenance of feeding and watering equipment.
- Assessment of basic forage quality for suitability as feed.
- Recording systems, including feed boards, databases and online recording systems.
- Facilities for feed storage to maintain quality.
- Weight gain and maintenance at each life stage.

B3 Grazing

- Grazing, including methods, grass height, stocking rates, feed intake.
- Continuous and rotational grazing systems.
- Assessment and establishment of grazing systems to lower farm carbon footprint and improve herd health.
- Grazing and stocking rates:
  - checking fences, gates and frequently used tracks to grazing
  - maintenance of water troughs and ensuring adequate access for herd number
  - toxic weed management
  - inspection and assessment of grazing suitability.

B4 Nutritional problems

- Possible signs of a nutritional problem, including poor appetite, reduced growth and lethargy.
- Common nutritional health issues, including specific nutrient deficiencies, excesses, parasitism and disorders.
- Causes, treatment and prevention of nutritional problems.

Learning aim C: Carry out routine husbandry of cattle during the production cycle to meet current welfare and husbandry standards

C1 Routine husbandry

Routine husbandry to maintain a healthy herd and ensure high levels of animal welfare.

- Routine husbandry:
  - treatments and prevention of disease, including external and internal parasite treatments (drench and dose), vaccinations, nutrition
  - feeding and watering procedures and routines
  - maintenance of housing, including cleaning out, bedding down, repairs
  - routine animal health and welfare checks
  - unit hygiene, including cleanliness, tidiness, disinfectant use
  - role of veterinary medicines in treating and controlling disease
  - responsible use of medicines under the regulations set out by the Veterinary Medicines Directorate (VMD), including measures to prevent or control exposure, reading the label and data sheets, engineered controls, competence and training requirements
  - specific signs of normal and abnormal health, including health checking, actions to prevent decline of health status and when to seek veterinary assistance

  - record keeping, including veterinary medicines book, record of births and deaths and husbandry records
  - isolation of replacement stock
  - government requirements for movement documentation and standstill
  - health and safety and risk assessments, use of personal protective equipment (PPE).
- Routine calf husbandry:
  - handling and restraint of calves, including handling, temperature
  - disbudding
  - removal of supernumerary teats
  - attaching ear tags
  - castration.
- Routine husbandry for adults:
  - handling and restraint of adults, including handling, temperature, halter, grooming, transport, inspection, marking and clipping
  - body condition scoring
  - identifying lameness.

C2 Care of calves

Maintaining high levels of animal welfare in accordance with legislative requirements and best practice guidelines.

- Preparations for pre-calving and calving, e.g.:
  - feeding programme planning, including planned weight gains and quantities
  - feeding methods for a herd of in-calf cows
  - methods of preventing abortion and dealing with aborting cows
  - identifying cows that need assistance, including dystocia, oversized calf and incorrect presentations
  - importance of the calf–cow bond
  - identifying and preventing metabolic problems in cows
  - scanning and marking
  - assessment of animal health and welfare, including indicators of good and bad health.
- Care of the newborn calf or young stock to ensure high welfare and maximise survival:
  - importance of adequate colostrum and colostrum quality, including use of hygrometers
  - navel treatments
  - use of probiotics and prebiotics
  - feeding calves using a stomach tube
  - common problems, treatments and prevention, including lethargy, scouring, dehydration, acidosis and pneumonia
  - disease prevention in calves during the first few months of life
  - taking the temperature of calves correctly
  - artificial rearing of rejected calves.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate beef production systems		**A.D1** Demonstrate proficient selection of animals for market and end of use, evaluating the impact of a beef cattle production system and accurate selection on overall production outcomes.
A.P1 Explain a production system for beef cattle. **A.P2** Demonstrate competent selection of animals for market and end of use, using performance indicators.	**A.M1** Analyse the impact of a beef cattle production system and accurate selection of stock on overall performance and production outcomes. **A.M2** Demonstrate effective selection of animals for market and end of use.	
Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets		**B.D2** Demonstrate, with a high degree of accuracy, the feeding and grazing management of beef cattle to maintain health and production targets, evaluating the impact of nutrition and feeding and diet management tasks.
B.P3 Explain the importance of diet management and feeding practices throughout the beef production cycle. **B.P4** Demonstrate competent diet and grazing management of beef cattle to maintain health and production targets.	**B.M3** Analyse the impact that nutrition, diet management and feeding have on health and production targets. **B.M4** Demonstrate efficient diet and grazing management of beef cattle to maintain health and production targets.	
Learning aim C: Carry out routine husbandry of cattle during the production cycle to meet current welfare and husbandry standards		**C.D3** Demonstrate, with a high degree of accuracy, routine husbandry of beef cattle to maintain health and production objectives and meet requirements for care of young stock.
C.P5 Demonstrate competent routine husbandry of beef cattle to meet health and production targets. **C.P6** Demonstrate competent routine husbandry tasks required for care of young stock.	**C.M5** Demonstrate efficient routine husbandry of beef cattle to maintain health and production targets and meet requirements for care of young stock.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M3, B.M4, C.M5, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- commercial beef production units
- relevant husbandry equipment
- beef cattle at the centre
- markets/abattoirs to visit.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will provide an in-depth review of one beef production system with specific breeds, thoroughly considering breed suitability and how accurate selection of stock affects overall production outcomes. They will make comprehensive, accurate connections between key factors within the production system and the requirements to select the most suitable breed to meet production targets. Learners will comprehensively review secondary information on the selected production method, with a robust evaluation of the advantages and disadvantages, and logical justifications regarding the most suitable breeds. They will show depth of understanding to identify accurately those animals ready for market and end of use, giving valid, well-reasoned justifications for their views. Learners will show breadth and depth of knowledge and understanding of performance indicators as a measure of success and the implications for health and welfare, using specific technical language appropriately throughout. Learners will consistently recommend relevant, insightful strategies to improve animal welfare in the production cycle.

For Merit standard, learners will make relevant, analytical judgements on one beef production system with specific breeds, breed suitability and on overall production outcomes. They will make mainly relevant connections between the different aspects of the production system and the requirements to select the most suitable breed to meet production targets. Learners will provide a clear review of secondary information on the selected production method, with a clear analysis of the advantages and disadvantages. They will show breadth and some depth of understanding when identifying those animals ready for market and end of use, giving mostly valid justifications for their views. Learners will show breadth and some depth of understanding of performance indicators as a measure of success and the implications on health and welfare. The evidence will use specific, accurate terminology. Learners will, at all times, show relevant and realistic consideration of animal welfare in the production cycle, making mostly relevant recommendations for improvements.

For Pass standard, learners will give a limited, realistic account of one beef production system with specific breeds and breed suitability, and the most obvious factors that affect the selection of cattle for market. They will show a basic understanding of how correct selection affects overall production targets, making basic connections between the key factors within the production system and the requirements for selecting the most suitable breed to meet production targets. Learners will use some secondary information on the chosen production method to identify some relevant advantages and disadvantages, giving basic explanations for their choice of the most suitable breeds.

They will recall knowledge to identify those animals ready for market and end of use, but will not provide justifications for their views. Learners will show limited breadth and depth of understanding of performance indicators as a measure of success and the implications for health and welfare, using some relevant terminology. Learners will, at all times, consider animal welfare in the production cycle, identifying basic changes that could be made.

Learning aims B and C

In order to achieve learning aims B and C, learners must demonstrate the required knowledge and skills within the context of a chosen beef production system. Teachers should ensure that the beef production system selected by learners provides sufficient scope for them to fully complete the assessments.

In achieving learning aims B and C, where learners present evidence of caring for young animals, 'young' is defined as being between newborn and nine months of age.

For Distinction standard, learners will demonstrate the practical skills required to care for a production herd and individual adult and young animals to a standard that reflects best practice in the workplace. They will carry out all the practical tasks confidently, showing a high degree of initiative within the limits of their responsibility.

Learners will evidence insightful strategies to minimise risks, demonstrating proficient safe working practices throughout. They will select the correct equipment, using it safely and accurately. They will ensure that animal welfare is maintained effectively and disruption to the animals is minimised. Learners will demonstrate proficiency in complying with biosecurity policies and procedures. They will show depth of understanding of the activities affected by biosecurity, how to take action to prevent non-compliance, and the consequences of biosecurity breaches. Learners will keep detailed and accurate records as appropriate to the tasks being carried out.

Learners will carry out feeding and diet management with a high degree of accuracy, ensuring the required foodstuffs are available and prepared, and informing others if there are problems. They will show depth of understanding of the importance of diet management within a beef production system and its potential impact through a detailed review of nutritional requirements, feeding practices and common nutritional problems (causes, treatments and prevention), with well-reasoned recommendations for improvement.

Learners will carry out routine husbandry activities with relevant animals such as calves, cows, bulls, steers and heifers, demonstrating a robust understanding of the practices used to care for the animals. They will make convincing connections between good husbandry and healthy cattle. They will show in-depth understanding of the importance of animal welfare and the need to review and maintain it as part of normal operation. They will show clear understanding that recognising and dealing with ill health in livestock is part of routine husbandry, demonstrating this when carrying out their activities. Learners will recognise the common signs of ill health in cattle, showing accurate knowledge of how to treat common diseases and disorders. They will review their approaches to carrying out routine husbandry activities and feeding and diet management in terms of their effectiveness in maintaining good health and hygiene of livestock. Learners will explore thoroughly where they were successful and where approaches could be improved or carried out differently.

Learners' evidence will use specific, accurate terminology throughout.

For Merit standard, learners will demonstrate the practical skills required to care efficiently and safely for a production herd and individual adult and young animals. They will carry out the practical tasks competently and show some initiative within the limits of their responsibility. Learners will show efficient use of time and resources, and meet the key requirements for animal welfare. They will assess the risks and hazards, using the required equipment safely and competently. Learners will demonstrate competency in complying with biosecurity policies and procedures. They will show clear understanding of most activities that are affected by biosecurity and how to take action to prevent non-compliance. Learners will keep records, as appropriate to the tasks and with sufficient detail, so it is clear what has been carried out.

Learners will carry out feeding and diet management correctly, making efficient use of resources, and with some preparation of foodstuffs. They will show clear understanding of the importance of diet management within a beef production system and its potential impact, through providing details of nutritional requirements, feeding practices and grazing management, making mostly valid recommendations for improvement.

Learners will competently carry out routine husbandry activities with relevant animals such as calves, cows, bulls, steers and heifers, demonstrating sound understanding of the practices used to care for the animals and making relevant connections between good husbandry and healthy cattle. They will demonstrate a clear understanding of the importance of animal welfare and the need to maintain it as part of normal operation. Learners will show understanding that recognising and dealing with ill health in livestock is part of routine husbandry, demonstrating this when carrying out some of their activities, but there may be some minor omissions. They will recognise the common signs of ill health in cattle and show some knowledge of how to treat common diseases and disorders. Learners will reflect on the approaches they used, making clear connections to their impact on the good health and hygiene of livestock, with mainly relevant recommendations for improvement.

Learners' evidence will use specific, appropriate technical terminology.

For Pass standard, learners will demonstrate the practical skills required to care for a production herd and individual adults and young animals safely and competently. They will carry out the practical tasks appropriately, showing little initiative within the limits of their responsibility.

Learners will work safely, with a realistic, limited awareness of the risks and potential issues arising when carrying out routine feeding and husbandry in a beef production system. They will use the appropriate equipment and leave the area clean and tidy on completion. Learners will show a realistic awareness of the importance of complying with biosecurity policies and procedures. They will recall knowledge of most activities that are affected by biosecurity and outline actions to prevent non-compliance. Learners will show an awareness of the need to keep appropriate records, providing the key information.

Learners will carry out feeding and diet management safely and competently, demonstrating a realistic, limited awareness of the importance of minimising the wastage of resources. They will recall basic knowledge to explain the nutritional requirements, feeding practices and grazing management for a beef production system.

Learners will carry out routine husbandry activities with care of relevant animals such as calves, cows, bulls, steers and heifers, demonstrating some relevant understanding of the practices used to care for the animals. They will carry out basic routine care and identify tasks to be completed in a generally appropriate order. Learners will make basic, realistic links between good husbandry and healthy cattle. They will show an appropriate awareness of how to maintain the welfare of animals as part of normal operation and the need to maintain it at all times. Learners will show a realistic awareness that recognising and dealing with ill health in livestock is part of routine husbandry, demonstrating this when carrying out some of their activities, but this will be limited. They will identify the common signs of ill health in cattle and show limited knowledge of how to treat common diseases and disorders. Learners will demonstrate a realistic but undeveloped understanding of how the approaches they used link to the good health and hygiene of livestock.

Learners' evidence will use some relevant terminology but there may be omissions.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 10: Farm Livestock Husbandry
- Unit 15: Livestock Health and Diseases
- Unit 16: Livestock Nutrition.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills when investigating animal production
- presentation and formal written communication skills when maintaining animal health
- self-management and planning skills when completing animal nutrition records.

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Unit 14: International Dairy Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the knowledge and skills needed to carry out feeding and husbandry practices to raise dairy cows successfully in dairy production systems.

Unit introduction

A dairy industry is part of a significant food chain and stakeholders need to work together to overcome the environmental challenges of food production and sustainability. This unit focuses on the need to maintain a sustainable level of dairy production while considering at all times the need for high standards of care and welfare for the animals concerned.

In this unit, you will investigate different dairy production systems such as housed systems, the grass-based system, the extensively grazed system and the associated cow and calf accommodation. You will carry out routine feeding and husbandry tasks throughout the production cycle as part of the management of breeding cows and newborn calves. You will find out how production affects animal welfare and develop skills in meeting the nutritional requirements of cows at different stages in the production cycle, including feed ingredients and ration formulation. You will develop a clear understanding of the legal, economic and environmental factors that contribute to decision making in dairy production. This will allow you to make informed decisions in relation to future dairy production.

This unit will help you to progress to employment, working within dairy enterprises in roles such as stockperson or dairy operative, or to higher-education courses in areas such as animal science, agriculture or agricultural business.

Learning aims

In this unit you will:

A Investigate dairy production systems and dairy cow welfare

B Carry out diet management and feeding practices during the production cycle to maintain health and production targets

C Carry out routine husbandry of dairy cows during the production cycle to meet current welfare and husbandry standards.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate dairy production systems and dairy cow welfare	**A1** Dairy production systems **A2** Dairy cow welfare **A3** Dairy cow reproduction	A report on a selected dairy production system and the production cycle.
B Carry out diet management and feeding practices during the production cycle to maintain health and production targets	**B1** Nutritional requirements **B2** Diet management and feeding practices **B3** Grazing **B4** Nutritional problems	A portfolio of evidence, to include: • planning documents • evidence of carrying out routine dairy cow feeding and husbandry tasks safely to meet current standards and health and production targets.
C Carry out routine husbandry of dairy cows during the production cycle to meet current welfare and husbandry standards	**C1** Milk hygiene **C2** Routine husbandry **C3** Health and disease	

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Content

Learning aim A: Investigate dairy production systems and dairy cow welfare

A1 Dairy production systems

- Current national conditions in the dairy industry, including current dairy cattle numbers, range of dairy produce, current national and global consumer trends.
- Dairy production systems:
  - housed systems, including zero-grazing system, cubicle and loose-housing systems
  - grass-based system
  - extensive grazed system.
- Factors affecting choice of production system, including financial, economic, marketing, availability of services, current farming practices, environmental factors, current legislative requirements and sustainable production techniques.
- Housing and rearing systems for calves, including buckets, group pens, automatic feeders, hutches, ventilation and draught, bedding, pen dimensions.
- Biosecurity measures in dairy production, including disinfectant foot dips, lorry wheel wash.
- Environmental impact and pollution control.
- Other factors associated with biosecurity, including health and safety, biosecurity levels, movement and transport of cows, pest and vermin control, feeding, water and bedding, people, equipment.
- Nitrate Vulnerable Zones.

A2 Dairy cow welfare

- Factors affecting welfare, including housing, milk yield, culling of adults and bull calves, large-scale dairy farming, medicines/hormone usage, animal handling and on-farm milking/handling systems, nutrition and animal needs.
- Governmental/non-governmental authorities/bureaus for animal health/food production, organisations involved in the welfare of dairy cows, animal welfare organisations/charities, industrial bodies.
- Impact of milk production on the cow and calf, including physiological and psychological stress.
- Legal obligations, codes of practice and welfare improvement schemes.

A3 Dairy cow reproduction

- Oestrus and pregnancy:
  - oestrus cycle
  - heat detection, including signs, aids, frequency, relevance to calving interval and herd calving index
  - devices and techniques used to identify ovulation
  - use of artificial aids to conception, including heatmount detectors, hormonal injection, intra-vaginal devices
  - methods and techniques for pregnancy diagnosis.

- Reproductive technologies, including:
  - artificial insemination (AI)
  - hormone therapy
  - embryo transfer
  - sexed semen.
- Problems in rebreeding, including:
  - disease
  - timing of AI
  - body condition
  - deterioration of animal's welfare.
- Breeding records, including:
  - computer based
  - breeding boards
  - veterinary records.
- Select replacements:
  - breeding requirements, including linear assessment, bull selection
  - culling rate
  - numbers of heifers needed.

Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets

B1 Nutritional requirements

- Nutritional requirements of the herd at the various stages of the production cycle, including mid- and late pregnancy, calving, lactation, newborns.
- Types of feed, including forages, concentrates and supplemental feeding of root crops.
- Importance of energy, including energy levels in feeds, dry matter, metabolisable energy, energy levels in rations to match targets.
- Importance of protein, including crude protein, protein levels in rations.
- Dry cow and transition diets.

B2 Diet management and feeding practices

- Types of feeding and watering equipment, including automated equipment, hay feeders, creep feeders, feeding bins, trough feeders, water delivery systems.
- Cleaning and maintenance of feeding and watering equipment.
- Assessment of basic forage quality for suitability as feed.
- Maintenance of feeding hygiene practices.
- Storage and management of feeds, including reducing contamination and spoiling.
- Formulation of rations for each stage of the production cycle.
- Feeding behaviour of herds and individuals.
- Recording systems, including feed boards, databases and online recording systems.
- Facilities for feed storage to maintain quality.
- Weight gain and maintenance at each life stage.

B3 Grazing

- Assessment of grazing suitability, including methods, grass height, stocking rates, feed intake.
- Continuous and rotational grazing systems.
- Grazing systems to lower farm carbon footprint and improve herd health.

B4 Nutritional problems

- Possible signs of a nutritional problem, including poor appetite, reduced growth and lethargy.
- Common nutritional health issues, including specific nutrient deficiencies, excesses, parasitism and disorders.
- Causes, treatment and prevention of nutritional problems.

Learning aim C: Carry out routine husbandry of dairy cows during the production cycle to meet current welfare and husbandry standards

C1 Milk hygiene

- Clean milk production, including constituents of milk, the mammary gland, milk let-down and operator hygiene.
- Parlour preparation and milking routines, including machine milk cows, circulation cleaning, milking-machine maintenance.
- Current hygiene standards, including contamination by bacteria, faeces from soiled animals, foreign bodies, failure to detect abnormal milk, chemicals, metals and organics.
- Monitoring of milk hygiene, including Bactoscan, somatic cell count, antibiotics, taint and extraneous water.
- Mastitis and its control, including contagious and environmental pathogens, causes, treatment, prevention, five-point plans.

C2 Routine husbandry

- Routine husbandry:
  - feeding and watering
  - routine checks of health, disease diagnoses, heat detection
  - unit hygiene, including cleanliness, tidiness, disinfectant use
  - maintenance of housing, including cleaning out, bedding down
  - role of veterinary medicines in treating and controlling disease
  - the need for responsible use of veterinary medicines, including measures to prevent or control exposure, reading the label and data sheets, engineered controls, competence and training requirements
  - record keeping, including veterinary medicines book, record of births and deaths and husbandry records
  - isolation of replacement stock
  - government requirements for movement documentation and standstill
  - health and safety and risk assessments, use of personal protective equipment (PPE).

- Care of the calf, including:
  - calving, including preparation of calving area, signs, equipment, calf revival
  - rearing
  - colostrum and its importance
  - navel care to prevent infection
  - nutrition, including milk powder, whole milk, oesophageal groove, feed amounts, roughage, concentrates, water
  - weaning, including age, weight
  - specific calf-related tasks, handling and haltering, temperature, ear tags, including passports and legislation, disbudding, stomach tube, dehydration and electrolytes, vaccination.
- Care of the heifer, including:
  - rearing
  - lactation, including lactation curve and milk yields, drying off
  - home rearing
  - numbers required, including link to cow culling rate
  - growth targets
  - stocking rates
  - specific tasks, including handling, haltering.

C3 Health and disease

- Signs of normal and abnormal health, including health checking, actions to prevent decline of health status and when to seek veterinary assistance.
- Health and disease prevention in calves, including joint ill, pneumonia, scours, bloat, ringworm, brucellosis.
- Health and disease prevention in heifers, including Bovine Viral Diarrhoea (BVD), Infectious Bovine Rhinotracheitis (IBR), Rhino Syncytial Virus (RSV), Leptospirosis, internal and external parasites, Johne's, tuberculosis (TB); heat synchronisation.
- Metabolic diseases, including hypocalcaemia, hypomagnesaemia, acidosis and link to concentrate level.
- Foot problems, including treatment, foot trimming, prevention.
- Disposal of dead stock.
- Body condition scoring and foot and mobility scoring, including how these are indicators for welfare, husbandry standards and optimum performance.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate dairy production systems and dairy cow welfare		**A.D1** Evaluate a dairy cow reproduction and production system and the implications for animal welfare and productivity.
A.P1 Explain reproduction in the dairy cow. **A.P2** Explain a dairy production system and the impact on animal welfare and productivity.	**A.M1** Analyse a dairy cow reproduction and production system and their impact on animal welfare and productivity.	
Learning aim B: Carry out diet management and feeding practices during the production cycle to maintain health and production targets		**B.D2** Demonstrate, with a high degree of accuracy, diet management and feeding of dairy cows to maintain health and production targets, evaluating the impact of nutrition and own feeding and diet management tasks.
B.P3 Explain the importance of diet management and feeding practices throughout the dairy production cycle. **B.P4** Demonstrate competent feeding and diet management of dairy cows to maintain health and production targets.	**B.M2** Analyse the impact that nutrition, diet and feeding management have on health and production targets. **B.M3** Demonstrate efficient feeding and diet management of dairy cows to maintain health and production targets.	
Learning aim C: Carry out routine husbandry of dairy cows during the production cycle to meet current welfare and husbandry standards		**C.D3** Demonstrate, with a high degree of accuracy, routine husbandry practices to maintain health, production and milk hygiene targets, evaluating the impact of health and disease problems on production.
C.P5 Demonstrate competent routine husbandry practices in dairy production to meet health, production and milk hygiene targets. **C.P6** Explain common health and disease problems in dairy cows and their relevance to dairy production.	**C.M4** Demonstrate efficient routine husbandry practices in dairy production to maintain health, production and milk hygiene and targets. **C.M5** Analyse common health and disease problems in dairy cows and the impact on production.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, B.M3, C.M4, C.M5, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a commercial dairy farm
- dairy cows at the centre
- relevant handling and restraining equipment
- a laboratory for milk microbiology assessment
- markets/abattoirs to visit.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give an in-depth review of one dairy production system. They will make comprehensive, accurate connections between key factors within the production system and the requirements for maintaining productivity at desirable, realistic levels. Learners will comprehensively review secondary information on the selected production system, with robust evaluation of the advantages and disadvantages in relation to productivity. They will demonstrate in-depth understanding of dairy cow reproduction, including reproductive technologies and the associated breeding and rebreeding problems commonly encountered, making robust, detailed links to the cow's biological processes. Learners will demonstrate breadth and depth of understanding of the impact of the production system on dairy cow welfare and sustainable milk production, using specific terminology accurately throughout. Learners will consistently recommend relevant, insightful strategies to improve animal welfare in the production cycle.

For Merit standard, learners will make relevant, analytical judgements on one dairy production system. They will make mainly relevant connections between the different aspects of the production system and the requirements for maintaining productivity at desirable, realistic levels. Learners will provide a clear review of secondary information on the selected production system, with a clear analysis of the advantages and disadvantages in relation to productivity. They will give mostly valid justifications for the use of the production system. Learners will demonstrate breadth of understanding of dairy cow reproduction, reproductive technologies and the associated breeding and rebreeding problems commonly encountered, making clear links to the cow's biological processes. Learners will demonstrate breadth and some depth of understanding of the impact of the production process on dairy cow welfare and sustainable milk production. The evidence will use specific, accurate terminology. Learners will, at all times, show relevant and realistic consideration of animal welfare in the production cycle, making mostly relevant recommendations for improvements.

For Pass standard, learners will give a limited, realistic account of a dairy production system. They will make basic connections between the most obvious factors within the production system and the requirements for maintaining productivity at desirable, realistic levels. Learners will use some secondary information on the selected production method to identify the advantages and disadvantages, giving a basic explanation for their choice. They will show a basic understanding of dairy cow reproduction, including reproductive technologies and the associated breeding and rebreeding problems commonly encountered, making some relevant links to the cow's biological processes.

Learners will show a realistic awareness of the impact of the production process on dairy cow welfare and sustainable milk production, but the evidence will be limited in scope or unbalanced in parts. Learners will use some relevant terminology. They will, at all times, consider how to improve animal welfare in the production cycle, identifying basic changes that could be made.

Learning aims B and C

In order to achieve learning aims B and C, learners must demonstrate the required knowledge and skills within the context of a chosen dairy production system. Teachers should ensure that the dairy production system selected by learners provides sufficient scope to ensure they can fully complete the assessments.

For Distinction standard, learners will demonstrate the practical skills required to care for a production herd and individual animals to a standard that reflects best practice in the workplace. Learners will carry out all the practical tasks confidently, showing a high degree of initiative within the limits of their responsibility.

Learners will evidence insightful strategies to minimise risks, demonstrating proficient safe working practices throughout. They will select the correct equipment, using it safely and accurately. They will ensure that animal welfare is maintained effectively and disruption to the animals is minimised. Learners will demonstrate proficiency in complying with biosecurity policies and procedures. They will show depth of understanding of the activities affected by biosecurity, how to take action to prevent non-compliance, and the consequences of biosecurity breaches. Learners will keep detailed and accurate records as appropriate to the tasks being carried out.

Learners will carry out feeding and diet management with a high degree of accuracy, ensuring the required foodstuffs are available and prepared, and informing others if there are problems. They will show depth of understanding of the importance of diet management within a dairy production system through a detailed review of nutritional requirements, feeding practices and grazing management, with well-reasoned recommendations for improvement.

Learners will carry out routine husbandry activities with calves and heifers, demonstrating a robust understanding of the practices used to care for the animals. They will make convincing connections between good husbandry and healthy cows. Learners will show in-depth understanding of the importance of animal welfare and the need to review and maintain it as part of normal operation. They will demonstrate an in-depth understanding of common health and disease problems in dairy production and their impact on animal health, along with treatments and prevention strategies. Learners will review their approaches to carrying out routine husbandry activities, feeding and diet management in terms of their effectiveness in maintaining good health and hygiene of livestock. They will explore thoroughly where they were successful and where approaches could be improved or carried out differently.

Learners' evidence will use specific, accurate terminology throughout.

For Merit standard, learners will demonstrate the practical skills required to care efficiently for a production herd and individual animals. They will carry out the practical tasks competently and show some initiative within the limits of their responsibility. Learners will show efficient use of time and resources, and meet the key requirements for animal welfare. They will assess the risks and hazards, using the required equipment safely and competently. Learners will demonstrate competency in complying with biosecurity policies and procedures. They will show clear understanding of most activities that are affected by biosecurity and how to take action to prevent non-compliance. Learners will keep records, as appropriate to the tasks and with sufficient detail, so it is clear what has been carried out.

Learners will carry out feeding and diet management correctly, making efficient use of resources, and with some preparation of foodstuffs. They will show a clear understanding of the importance of diet management within a dairy production system through providing details of nutritional requirements, feeding practices and grazing management, making mostly valid recommendations for improvement.

Learners will competently carry out routine husbandry activities with calves and heifers, demonstrating a clear understanding of the practices used to care for the animals and maintain milk hygiene and making relevant connections between good husbandry and healthy cows. They will demonstrate a clear understanding of the importance of animal welfare and the need to maintain it as part of normal operation.

Through their evidence, learners will show an understanding of common health and disease problems in dairy production along with some understanding of treatments and prevention strategies. They will demonstrate a clear understanding of how health and disease problems impact on production and provide mostly relevant reasons for their views. Learners will reflect on the approaches they used and make clear connections to their impact on the good health and hygiene of livestock, with mainly relevant recommendations for improvement.

Learners' evidence will use specific, appropriate technical terminology.

For Pass standard, learners will demonstrate the practical skills required to care for a production herd and individual animals safely and competently. They will carry out the practical tasks appropriately, showing little initiative within the limits of their responsibility.

Learners will work safely, with a realistic, limited awareness of the risks and potential issues arising when carrying out routine feeding and husbandry in a dairy production system. They will use the appropriate equipment and leave the area clean and tidy on completion. Learners will show a realistic awareness of the importance of complying with biosecurity policies and procedures. They will recall knowledge of most activities that are affected by biosecurity and outline actions to prevent non-compliance. Learners will show an awareness of the need to keep appropriate records, providing the key information.

Learners will carry out feeding and diet management safely and competently, demonstrating a realistic, limited awareness of the need to ensure minimal wastage of resources. They will show basic understanding of the significance of the role of feeding and diet management in the production cycle. Learners will recall basic knowledge to explain the nutritional requirements, feeding practices and grazing management for a dairy production system.

Learners will carry out routine husbandry activities with calves and heifers, demonstrating some relevant understanding of the practices used to care for the animals and maintain milk hygiene. They will carry out basic routine care, making realistic links between good husbandry and healthy cows. Learners will show an appropriate awareness of how to maintain the welfare of animals as part of normal operation and the need to maintain it at all times.

Learners will show some breadth of understanding of common health and disease problems in dairy production, along with a limited understanding of treatments and prevention strategies. They will show realistic, limited understanding of the most obvious ways in which common health and disease problems affect dairy production, giving some relevant reasons or examples of these implications. Learners will show a realistic awareness that recognising and dealing with ill health in livestock is part of routine husbandry, demonstrating this when carrying out some of their activities, but this will be limited. Learners will demonstrate a realistic but undeveloped understanding of how the approaches they used link to the good health and hygiene of livestock.

Learners' evidence will use some relevant terminology but there may be omissions.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 10: Farm Livestock Husbandry
- Unit 15: Livestock Health and Diseases
- Unit 16: Livestock Nutrition.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research, presentation and communication skills when investigating animal health
- analysis skills when reflecting on a given animal production issue
- independent working practices when moving animals.

Unit 15: Livestock Health and Diseases

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills to manage livestock health through the monitoring and recording of animal health, and the implementation of prevention methods to protect animals from diseases.

Unit introduction

Animals can become ill and, unlike humans, they cannot explain what might be wrong. As a stockperson, it is vital that you can reduce the risk of illness happening, recognise signs that indicate a disease or disorder may be present and manage the health of animals in your care.

In this unit, you will study the causes, signs and treatments of illness and disease in livestock, along with how pathogens and parasites grow, reproduce and cause infection. This will help you to understand infection identification and control, and the different treatment options available. You will explore practical ways to assess and manage livestock health, including assessment techniques, how to apply basic treatments and implementation of preventative measures. You will learn about the importance of, and skills involved in, planning strategies for managing livestock health along with monitoring and recording health and health care interventions. This will help you to promote and maintain the health status and productivity of livestock species.

The skills you learn in this unit are key to employment in the animal sector, including zoos, farms, and pet-related industries, and for progression to a higher-education course in, for example, animal science and veterinary nursing.

Learning aims

In this unit you will:

A Understand how pathogens and parasites impact on livestock health management

B Undertake health assessments for effective management of livestock health and welfare

C Explore livestock health management strategies to prevent and control ill health.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Understand how pathogens and parasites impact on livestock health management	**A1** Structure and reproduction of pathogens and parasites, and disease transmission **A2** Defence against disease	A report exploring the structure, growth, reproduction and transmission of disease caused by pathogens and parasites of livestock.
B Undertake health assessments for effective management of livestock health and welfare	**B1** Assessing general health in animals **B2** Livestock diseases and disorders	A portfolio of evidence, including: • witness statements and observation records of practical activities assessing the health of three different livestock species • witness statements and observation records of practical activities recording and monitoring livestock health • livestock health management plans and rationales • report on the management of two diseases and disorders and two infestations in livestock health, productivity and welfare planning.
C Explore livestock health management strategies to prevent and control ill health	**C1** Health and hygiene **C2** Theory and administration of basic treatments and health management **C3** Health planning, assessment, recording and monitoring	

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Content

Learning aim A: Understand how pathogens and parasites impact on livestock health management

A1 Structure and reproduction of pathogens and parasites, and disease transmission

External and internal structure, life cycles and reproduction methods, pathogenesis and aetiology of diseases as appropriate to different types of pathogen and parasites.

- Bacteria:
  - cellular structure, including cell wall, membrane, DNA structures, flagella, morphology of bacteria, Gram-positive and Gram-negative
  - asexual reproduction and sexual reproduction, horizontal and vertical gene transmission, to include transfer of antibiotic-resistant genes
  - bacterial disease, e.g. *Bacillus anthrax*, *Salmonella* spp, *Escherichia coli* spp *Mycobacterium bovis* and *Mycoplasma* spp.
- Viruses:
  - genome, capsid, morphology, capsomeres, nucleocapsid and envelopes, including bacteriophages
  - replication in host cells
  - viral diseases, e.g. bluetongue (BTV-8), foot and mouth disease (FMDV), influenza
  - prions, e.g. scrapie, bovine spongiform encephalopathy (BSE).
- Fungi:
  - cellular structure of yeast and moulds
  - asexual and sexual
  - fungal disease, e.g. food-borne mycotoxins, ringworm and *Aspergillus* spp.
- Parasites:
  - hosts and locations of life-cycle stages
  - lice, to include species of sucking and biting lice
  - mites, to include species of sucking and burrowing mites
  - worms (intestinal, stomach and lung), e.g. *Taenia* spp, *Haemonchus contortus*, *Dictyolcaulus* spp.
  - flukes, e.g. Fasciola hepatica
  - coccidia.
- Interaction with host, to include:
  - direct damage to cells
  - effect of toxin production
  - physiological response of host.
- Modes of transmission and average lengths of contamination, to include:
  - touch
  - body fluids (blood, semen, mucus, saliva)
  - air
  - food
  - water
  - insect vectors, e.g. flies
  - fomites, e.g. bedding and barbed wire.

- Growth of bacteria, viruses and fungi:
  - environmental factors affecting growth, including temperature, pH, water, oxygen, and the practical meaning of this in an animal's surroundings.

A2 Defence against disease

The role of the immune system in disease and prevention of disease in livestock.

- Non-specific (innate) immune response:
  - natural barriers to infection, including mechanical barriers, epithelia, and chemical and biological defence
  - inflammation, e.g. heat, swelling and pain
  - phagocytosis
  - role of blood in defence against disease, including blood clotting and thrombosis.
- Adaptive (acquired) immunity:
  - humoral immunity, antibody-mediated immunity
  - cell-mediated immunity
  - leucocyte structures and functions
  - adaptive immune system, including specific responses and interactions of different types of B cell and T cell.
- Different types of immunity:
  - natural/artificial and active/passive.
- Vaccination – interaction with the immune system, mode of action in the body and effectiveness over time, to include:
  - live attenuated
  - inactivated vaccines
  - toxoid vaccines
  - subunit vaccines.

Learning aim B: Undertake health assessments for effective management of livestock health and welfare

B1 Assessing general health in animals

Techniques and equipment used to establish the health status of livestock, to include the indicators of good and poor health as appropriate in cattle, deer, game birds, goats, sheep and poultry.

- Indicators of health status in livestock species, to include:
  - behaviour, posture and movement
  - coat or feather condition
  - weight
  - body condition score
  - presence of lumps/bumps
  - normal parameters of temperature, pulse and respiration
  - normal levels and colour of discharge from eyes, ears and nose
  - intactness, colour and presence of teeth
  - colour and moistness of mucous membranes
  - colour of comb
  - faeces/urine output, e.g. volume, colour, texture.

- Assessment techniques and equipment as appropriate, to include:
  - condition scoring
  - weighing and measuring
  - postural changes
  - environmental assessment.

B2 Livestock diseases and disorders

Clinical signs, treatments, prognosis and prevention of livestock diseases and disorders as appropriate to cattle, deer, game birds, goats, sheep and poultry, to include when, why and how notifiable diseases must be reported.

- Bacterial infections, e.g. *Bacillus anthrax*, *Salmonella* spp, *Escherichia coli* spp and *Mycobacterium bovis*, *Mycoplasma* spp.
- Viral diseases, e.g. bluetongue (BTV-8), foot and mouth disease (FMDV), influenza.
- Fungal disease, e.g. food-borne mycotoxins, ringworm and *Aspergillus* spp.
- Prions, e.g. scrapie and bovine spongiform encephalopathy (BSE).
- Parasites, to include lice, mites, worms (intestinal, stomach and lung), flukes and coccidia.
- Zoonotic and notifiable diseases, to include anthrax, avian influenza, bovine spongiform encephalopathy (BSE), brucellosis, coxiella, foot and mouth, orf, rabies, ringworm, scrapie and tuberculosis.
- Nutritional disorders:
  - obesity
  - food toxicity, e.g. acidosis, dehydration.
- Endocrine disorders and their clinical signs, treatment and prevention.
- Metabolic disorders:
  - hypocalcaemia and hypomagnesaemia
  - ketosis.

Learning aim C: Explore livestock health management strategies to prevent and control ill health

C1 Health and hygiene

Appropriate uses, advantages and disadvantages of techniques and equipment required to prevent the transmission or development of diseases in cattle, deer, game birds, goats, sheep and poultry.

- Antimicrobial agents:
  - soap, including correct hand-washing techniques
  - external use of antiseptics on living organisms, to include alcohols, chlorhexidine and iodine
  - use of disinfectants on non-living objects, to include foot dipping, cleaning and disinfecting housing, vehicles and workers
  - factors affecting effectiveness of antimicrobial agents, e.g. frequency of cleaning and disinfection, impact of incorrect dilution rates.
- Sterilisation of equipment, including different methods and equipment, e.g. heat, chemical, high pressure.

C2 Theory and administration of basic treatments and health management

Reasons for, advantages, disadvantages, equipment, methods and legal implications of administering different treatments and routine health management practices.

- Non-medical routine health maintenance:
  - nutrition regulation and weight control
  - bathing and skincare
  - dental care
  - foot/hoof care.
- Types of treatment:
  - antibiotics
  - nutrition management
  - anthelmintics for parasitic infections (topical and internal)
  - vaccines.
- Routes of administration for livestock medications:
  - gastrointestinal, including oral, gavage and rectal
  - parenteral, including subcutaneous, intramuscular, intradermal and intranasal
  - topical applications.
- Parasite treatment, to include:
  - oral (drenching, paste, tablets)
  - topical (spot on, spraying)
  - injection.
- Vector control, e.g. dipping, indoor housing, clipping.

C3 Health planning, assessment, recording and monitoring

Purpose, legal requirements, advantages and disadvantages of methods of keeping essential livestock health records as appropriate for cattle, deer, game birds, goats, sheep and poultry.

- Reasons for keeping records, e.g. passports for import and export, prevention of overdose/underdose, ease of tracking for others working with the livestock.
- Practical monitoring and recording, to include observation and physical examination/health checks.
- Herd or flock health plans.
- Key information and events to record:
  - births
  - identification of individuals, e.g. tagging, slap marking
  - movements
  - deaths and disposal of fallen stock.
- Key data to record and reasons for treatments administered, to include:
  - time, date
  - name, strength, amount and batch number of treatment
  - required frequency of treatment
  - withdrawal period, if applicable
  - person administering health records of animal before and after treatment and comments on change.

- Methods of record keeping, to include paper-based and electronic recording systems, e.g. treatment, monitoring and reporting forms.
- Production, monitoring and recording of health and hygiene plans:
  - management of environmental factors to prevent pathogen growth and disease transmission, to include best practice hygiene and isolation procedures
  - management practices, including grazing rotation, management of chemicals and waste
  - vaccination schedules
  - planning to manage disease outbreak, e.g. biosecurity measures, restriction of access, use of chemicals and risk assessment.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand how pathogens and parasites impact on livestock health management		
A.P1 Explain the structure, growth and reproduction of livestock pathogens and parasites. **A.P2** Explain the routes of transmission and effects on animal health of bacteria, viruses, fungi and parasites.	**A.M1** Analyse how the immune system of an animal species responds to the pathogenesis and transmission of organisms.	**A.D1** Evaluate the effectiveness of the immune system of an animal in responding to the growth and reproduction of pathogens and parasites.
Learning aim B: Undertake health assessments for effective management of livestock health and welfare		
B.P3 Perform techniques to assess livestock health in straightforward situations. **B.P4** Explain signs, treatments, prognosis and prevention of livestock diseases and disorders.	**B.M2** Assess the health of livestock efficiently in complex situations, analysing appropriate use of indicators and treatment options.	**B.D2** Evaluate the use of livestock health assessments to manage health in complex situations.
Learning aim C: Explore livestock health management strategies to prevent and control ill health		
C.P5 Carry out correct and safe routine recording and monitoring of interventions in livestock health management. **C.P6** Explain monitoring and record keeping in livestock health management.	**C.M3** Carry out efficient recording and monitoring of interventions in complex livestock health management situations, analysing ongoing monitoring regimes.	**C.D3** Evaluate effectiveness of own and existing livestock health management strategies, making recommendations for improvement.

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, CP.6, B.M2, C.M3, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- antimicrobial agents
- disinfectants and antiseptics
- different livestock species.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will articulate arguments concisely and professionally to evaluate the growth and reproduction of two examples of each type of disease/parasite (bacterial, viral, fungal and parasite) and the responses of the immune system. They will show depth of understanding through detailed explanation of the structure and function of pathogens and parasites, evaluating the effect of the environment on the growth and reproduction of all the organisms mentioned. Learners will use detailed analysis and research to explain the immune response in detail (including the involvement and interaction of different cell types), demonstrating a thorough understanding of the role of the immune system. They will include an evaluation of how the animal immune system can affect the symptoms of a disease.

For Merit standard, learners will reach reasoned, analytical judgements, considering how the immune system responds to the threat of infection. They will select and apply knowledge relating to pathogenesis and parasites of two examples of each type of disease/parasite (bacterial, viral, fungal and parasite), including route of transmission, where they reproduce and how they cause disease. Learners will explain the relationship between the immune system's structure and functions and how it responds to infection by pathogens and parasites.

For Pass standard, learners will demonstrate knowledge and understanding of the transmission route and effects of two examples of each type of disease/parasite (bacterial, viral, fungal and parasite), clearly identifying key structures, functions and methods of reproduction. They will outline the different types of reproduction of each pathogen and parasite. Learners will describe the innate physical and chemical barriers to pathogens and parasites, outlining the meaning and responses of different types of immunity (natural active, artificial active, natural passive and artificial passive).

Learning aims B and C

For Distinction standard, learners will safely carry out three detailed assessments of health in three livestock species, assessing all health indicators in the unit content. They will demonstrate proficient use of methods in assessing, recording and monitoring livestock health in more advanced situations. The practical assessments will be of similar complexity to those demonstrated at merit level.

Learners will demonstrate thorough research and analysis to rationalise planning of a range of appropriate livestock health management strategies, demonstrating a very good understanding of the advantages, disadvantages and legal implications of implementing plans to manage livestock health. They will consider the impact of clinical signs of two diseases or disorders and two infestations on the animal's health and welfare, explaining in detail how different treatments and preventative actions work in

each case. Learners will draw together knowledge and understanding from across the learning aims to make valid judgements about the risks and limitations of each method of health assessment, treatment options and preventative actions in relation to the causative agents and desired outcomes. They will make appropriate recommendations for improvement to the planning and practical implementation of livestock health management strategies in terms of health, productivity and welfare.

For Merit standard, learners will select and carry out appropriate methods to assess the health of three livestock species, modifying techniques to suit the context. They will select and use treatments and delivery methods appropriate to purpose, limitations and resource constraints and use suitable recording and monitoring methods, in an organised way that does not waste time or resources. Learners will competently address more complex situations, such as those where the number of animals is larger or where the amount of information that must be recorded as part of the monitoring is inherently greater.

Learners will demonstrate sound knowledge and understanding of the relationship between health and hygiene planning, livestock welfare and productivity. They will carefully consider clinical signs, treatments and prevention methods for two diseases or disorders and two infestations, reaching valid conclusions on the interventions and health management strategies which are likely to be most beneficial. They will reach reasoned, analytical judgements on the impact of clinical signs on the animal's health and welfare, explaining in detail how different treatments and preventions work in more complex situations, such as in a herd, flock or group situation. They will demonstrate good understanding of the purposes and practicalities of ongoing monitoring regimes, making salient judgements on decisions made in terms of health, productivity and welfare.

For Pass standard, learners will work in a safe and appropriate manner to correctly assess the health of three livestock species and implement basic health management strategies. Learners will demonstrate knowledge of each of the health indicators listed in the content as appropriate, linking the clinical signs of disease, different treatment options and preventions available for two diseases or disorders, and two infestations.

Learners will outline the key information that must be captured as part of the requirements of managing the health of livestock species and why they must be recorded, making reference to those that are legal requirements in addition to those which are good practice. They will select and use appropriate recording and monitoring methods. Learners will demonstrate correct knowledge and understanding of livestock health management strategies and ways in which good livestock health, productivity and welfare can be achieved.

Links to other units

This unit links to:

- Unit 9: Managing Environmental Activities in Agriculture
- Unit 10: Farm Livestock Husbandry.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local organisations
- contribution of ideas to unit assignment/project materials
- support from local farm staff, vets or inspectors as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills
- presentation and formal written communication skills
- analytical and evaluative practices
- mathematical skills when considering treatment dosages.

Unit 16: Livestock Nutrition

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners study the essential biological molecules and practical management of livestock nutrition.

Unit introduction

An understanding of animal nutrition is a fundamental part of livestock husbandry. A balanced diet is vital to the maintenance of animal health, welfare and production in farm livestock species. Understanding the function of each feed component allows you to give livestock appropriate feeds in the correct quantities for their species, breed, production level and age.

In this unit, you will learn how biological molecules are taken in, broken down and used by the animal. You will develop the skills needed to assess the nutritional value of feedstuffs and formulate the correct diet for maximum wellbeing and production of the livestock species in your care.

This unit will prepare you for work in an introductory role preparing feeds and rations for livestock species in a farming enterprise. It will also help you progress to a higher-education course in the field of agricultural science.

Learning aims

In this unit you will:

A Investigate the structure of biological molecules and their significance in livestock nutrition

B Examine the digestive systems of livestock species to allow appropriate nutrition

C Plan livestock diets to meet nutritional requirements.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the structure of biological molecules and their significance in livestock nutrition	**A1** Standard representation of biological molecules **A2** Biochemical concepts **A3** Macronutrients **A4** Micronutrients	A portfolio of evidence, including: • a report on the nutritional requirements of livestock species in relation to the nutritional importance of biological molecules.
B Examine the digestive systems of livestock species to allow appropriate nutrition	**B1** Digestive systems **B2** Feeding issues	
C Plan livestock diets to meet nutritional requirements	**C1** Nutrient analysis of feeds **C2** Practical considerations for feeding livestock	A portfolio of evidence, including: • analytical reports on the nutritional labelling of foodstuffs • fully annotated diet plans to highlight the importance of biological molecules in the diet • assessments of dietary plans, taking into account deficiencies, excesses and toxicities.

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Content

Learning aim A: Investigate the structure of biological molecules and their significance in livestock nutrition

A1 Standard representation of biological molecules

Written and drawn representations of biological molecules:

- formulae and projections of common nutritional compounds
- common functional groups, to include –COOH, –OH and the use of R to represent groups of atoms in molecules.

A2 Biochemical concepts

Considerations of the components of food and their contribution to the biochemical makeup of animals.

- Proportions of biological molecules in different animals.
- Differences in structure and function of organic (those containing carbon and hydrogen) and inorganic compounds.
- Energy changes associated with making and breaking bonds.
- Structural isomerism and relevance to animal nutrition.

A3 Macronutrients

Sources, structures, features, digestion processes and functions of macronutrients in the diets of monogastric, ruminant and poultry livestock species.

- Carbohydrates:
  - monosaccharides, including glucose, galactose, fructose
  - condensation reactions between monosaccharides to form disaccharides and polysaccharides containing glycosidic bonds
  - hydrolysis reactions
  - disaccharides, including lactose, maltose and sucrose
  - polysaccharides, including amylose and amylopectin.
- Role of carbohydrates in animals, e.g. as energy sources, in formation with other molecules (glycolipids, glycoproteins, nucleotides) and in the formation of polysaccharides.
- Dietary fibre (non-starch polysaccharides), e.g. cellulose, pectin, lignin, guar and xanthan:
  - role of insoluble fibre in digestive transit
  - role of soluble fibre in regulating blood sugar.
- Lipids:
  - structure and formation, including triglycerides and phospholipids
  - physical properties of circulated and uncirculated fatty acids
  - lipid breakdown and absorption, including absorption in the rumen.
- Role of lipids in animals, e.g. energy storage, in cell membranes, insulation, organ protection and waterproofing.
- Essential and non-essential amino acids:
  - importance of functional groups and formation of zwitterions
  - condensation reaction to form dipeptides and polypeptides
  - hydrolysis reactions to break down peptide bonds.

- Proteins:
  - primary, secondary (α helices and β pleated sheets), tertiary and quaternary structures of globular and fibrous proteins
  - the importance of hydrogen bonds, disulfide bridges, hydrophobic–hydrophilic interactions and ionic bonds in maintaining specific structure.
- Role of proteins in animals, e.g. as antibodies and enzymes, filaments in connective tissue, hormones, gas transport (haemoglobin), muscles and nutrient transporters (casein in milk, ovalbumin in eggs).
- Water:
  - polar nature, hydrogen bonding.
- Role of water in animals, including:
  - its importance in allowing the movement of substances around the body
  - providing a medium for chemical reactions to take place
  - maintaining body temperature
  - as a metabolite
  - osmotic influence on cell structure and blood pressure.

A4 Micronutrients

Structures, features, digestion processes and functions of micronutrients in the diets of monogastric, ruminant and poultry livestock species.

- Comparison of storage and requirement for fat- and water-soluble vitamins.
- Micronutrient absorption in the digestive system.
- Role of vitamins and minerals in the body, including retinol, ascorbic acid, cholecalciferol, folic acid, iron, calcium, phosphorous, magnesium, copper and zinc.

Learning aim B: Examine the digestive systems of livestock species to allow appropriate nutrition

B1 Digestive systems

Digestive system adaptations, location, structure and processes involved for digestion in monogastric, ruminant and avian livestock species.

- Oral cavity, dental formulae.
- Stomach chambers.
- Stages of feed movement through the digestive system.
- Location and action of microflora and microfauna in the digestive system.
- Digestion and absorption of macronutrients and micronutrients from feeds.
- Role of the pancreas and liver in digestion.
- Impact of factors such as stress and disease on effective nutrient absorption.

B2 Feeding issues

Causes, symptoms, and corrective measures of issues arising from nutritional imbalances and digestive system disorders in monogastric, ruminant and avian livestock species, including consequences if left untreated.

- Nutrient deficiencies, e.g. hypomagnesaemia, hypocalcaemia.
- Nutrient excesses, e.g. obesity, lactic acidosis.
- Ingestion of foreign bodies.
- Ruminant bloat.

Learning aim C: Plan livestock diets to meet nutritional requirements

C1 Nutrient analysis of feeds

Terminology and techniques used in methods of nutritional analysis and interpretation of results.

- Additional nutritional terminology: acid detergent fibre (ADF), additive, blending, bypass protein, cake, colostrum, crude protein, digestibility, dry matter, malnutrition, mash, metabolisable protein, metabolisable energy, neutral detergent fibre (NDF), non-protein nitrogen (NPN), protein equivalent, premix, supplement, undegradable protein.
- Quantitative and qualitative methods of analysing feedstuffs, including:
  - dry matter determination
  - testing for starch using iodine
  - Benedict's test for reducing sugars
  - biuret test for proteins
  - emulsion test for fats or oils
  - calorimetry.
- Nutritional values of macronutrients and of micronutrients in formulated and naturally occurring animal feedstuffs.

C2 Practical considerations for feeding livestock

Considerations and practical decision making for planning, preparing, storing, and presenting feedstuffs to livestock species.

- Planning and preparation of dietary plans for monogastric, ruminant and avian livestock species:
  - nutritional requirements considering life stage, production requirements and health status, e.g. maintenance, activity, growth and pregnancy
  - appropriate frequency and form of feedstuffs.
- Dietary calculations using manual and computerised methods for poultry, sheep and cattle, including:
  - ration design
  - ration formulation techniques including the Pearson square, algebraic calculations and computer software
  - balancing rations (meeting requirements by balancing energy and protein content of feeds)
  - forage analysis, including dry matter (DM%), fibre, digestibility, metabolisable energy (ME; MJ/kg DM) and crude protein (CP%).
- Suitability, advantages and disadvantages of different types of feed, including:
  - raw, fermented, cooked, live and dried feedstuffs
  - additives, substitutes and impurities
  - availability, ease and cost of formulation/purchase and storage
  - concentrates
  - differences between grass, hay, straw and silage and variations within
  - digestibility, including calculations
  - voluntary feed intake, e.g. ad libitum versus controlled diet.
- Importance of correct storage of feedstuffs, e.g. good hygiene and security to prevent spoiling, contamination and/or pest damage.

- Presentation of feedstuffs:
  - palatability (taste/texture/smell)
  - use of feed as environmental enrichment
  - creep feeding.
- Other factors including awareness of how nutrition and safety are regulated in pre-prepared animal feedstuffs.

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Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate the structure of biological molecules and their significance in livestock nutrition		**A.D1** Review the nutritional importance of biological molecules for maintaining normal function in livestock.
A.P1 Explain the structure and features of biological molecules in livestock nutrition. **A.P2** Discuss the role and sources of biological molecules in livestock nutrition.	**A.M1** Assess the structure and functions of biological molecules in livestock nutrition.	
Learning aim B: Examine the digestive systems of livestock species to allow appropriate nutrition		**B.D2** Evaluate digestive system adaptations and common feeding issues in livestock species.
B.P3 Explain the digestion and absorption of biological molecules. **B.P4** Explain the structures of digestive systems in livestock species and common feeding issues.	**B.M2** Compare the digestion and absorption of biological molecules in the digestive systems of livestock species.	
Learning aim C: Plan livestock diets to meet nutritional requirements		**C.D3** Plan complex diet formulations for different livestock species to meet nutritional, practical and production demands.
C.P5 Explain the nutritional content of livestock feeds. **C.P6** Plan simple diet formulations for livestock species.	**C.M3** Analyse the nutritional content of livestock feeds. **C.M4** Plan complex diet formulations for livestock species.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.M4, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- varied feedstuffs for different animals
- relevant equipment to carry out common food tests in the laboratory, such as:
  - iodine
  - Benedict's solution
  - ethanol
  - filter paper and funnels
  - glass beakers
  - spotting tiles
  - test tubes and racks
  - water baths/Bunsen burners, tripods, gauze, heat-proof mats.

Essential information for assessment decisions

Learning aims A and B

For Distinction standard, learners will produce comprehensive and detailed work that is accurate throughout. They will demonstrate a robust, accurate understanding of the links between the structure of biological molecules, their sources and the functions within the body of each selected species. Learners will give an in-depth account of the structure and adaptations of the digestive system of each animal, with specific reference to where and how biological molecules are digested and absorbed. They will make valid, logical connections between the nutritional needs of the animal and the causes, symptoms and treatments of common feeding issues that can occur.

For Merit standard, learners will provide clear, balanced ideas that show an appropriate level of detail and coherence, using images and diagrams in a suitable way to illustrate the key points they make. Learners will show breadth of understanding of the principles relating to the digestion, absorption and functions of biological molecules, identifying both the differences and similarities between the structure and functions of the digestive systems of the selected livestock species. They will give a mostly valid account of the common feeding issues that may occur in each species and the features of the biological molecules to which they relate.

For Pass standard, learners will demonstrate realistic but limited understanding of the sources and role of biological molecules that are important to each species of livestock. They will select and organise information, showing some breadth of understanding of the structure and functions of the digestive system of each livestock species, in addition to the location and processes of the digestion and absorption of each type of biological molecule considered. Learners will outline the key common feeding issues that may occur in each of the species, along with basic references as to why they occur and how they may be rectified. Learners' work will be correct throughout but will be limited in scope or unbalanced in parts.

Learning aim C

For Distinction standard, learners will produce a highly accurate and thorough plan for each livestock species. Learners will evaluate thoroughly the suitability of the diet, feed storage and feed preparation, making suitable justifications for recommendations. They will show breadth and depth of understanding by showing how the diet formulations will contribute to the animals' nutrition and production levels, relating this to detailed analysis and research to make specific, valid recommendations. Learners will draw on their knowledge and understanding from across the learning aims to justify the diet formulations planned for different animals, showing how the diets will provide animals with the appropriate biological molecules. They will demonstrate a robust grasp of the need to balance practical considerations with nutritional requirements, and how this may be achieved. The evidence will make use of appropriate, accurate terminology throughout.

For Merit standard, learners will produce a clear, nutritionally balanced plan for each livestock species that incorporates calculations for how this can be achieved with the combined use of appropriate feeds. The plan will be easily understood and interpreted. Learners will make reasoned judgements on the nutritional content of proposed feeds and the suitability of the diet. They will identify mostly relevant practical issues that may arise during the implementation of the feeding plan and diet formulation, highlighting how these may be overcome. The evidence will be detailed and supported by mostly relevant examples. The diet formulation and feed preparation will be clearly linked to the nutritional demands and the statuses of the selected animals, and no key factors will be omitted. The evidence will contain mostly appropriate, accurate use of terminology.

For Pass standard, learners will give a limited plan that meets the basic nutritional requirements of the selected animals. The plan will be realistic but may be lacking in detail or reasoning. Learners will recall and relate knowledge to discuss the nutritional content of animal feeds. They will consider how the feeds relate to the nutrition of the animal and the extent to which the nutritional content in the feeds is important, but a conclusion is not required. Learners must use relevant research and select and organise information in their plan, making suitable judgements and providing feasible solutions to identified problems. There may be some minor irrelevancies in the evidence, which will show some use of relevant terminology.

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Links to other units

This unit links to:

- Unit 7: Work Experience in the Land-based Sectors
- Unit 9: International Poultry Production
- Unit 10: Farm Livestock Husbandry
- Unit 11: International Pig Production
- Unit 12: International Sheep Production
- Unit 13: International Beef Production
- Unit 14: International Dairy Production
- Unit 15: Livestock Health and Diseases.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local organisations
- contribution of designs/ideas to unit assignment/scenario/case study/project materials, including own organisation materials as exemplars where appropriate
- feedback from staff from local organisations on plans/designs/items developed
- opportunities for observation of organisational application during work experience
- support from local organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research, presentation and communication skills when investigating animal health
- analysis skills when reflecting on a given animal production issue
- independent working practices when moving animals.

Unit 17: Crop Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills to undertake crop maintenance, harvest and storage. They gain a detailed understanding of crop species and products.

Unit introduction

Crop production underpins all aspects of agriculture, forming the basis of all products of the industry, including animal feedstuffs and bedding, human food, pharmaceutical and industrial products, fuel and fibre.

In this unit, you will gain the skills needed to identify a range of commercially grown crops and their products, including annual, biennial and perennial plants. You will find out how and why crops are grown in specific situations and how crop growth is maintained throughout the production cycle. This will include recognising weeds, pests, diseases and deficiency symptoms, together with recommendations of remedial action that can be undertaken. You will understand the principles of harvesting and develop harvesting skills. You will investigate how crops are monitored in store, and consider how crops are treated while there, to maintain them in an acceptable condition. In order to maintain or improve the quality of crop products, you will learn about conditioning, cleaning, sorting and grading, together with the use of associated equipment.

This unit will help you to progress to employment or further education. The insight gained from this unit will help to prepare you for and inform you of the challenges and opportunities facing the agriculture industry in the 21st century as food security becomes increasingly important, both nationally and globally.

Learning aims

In this unit you will:

A Understand crop species and their products
B Establish and maintain healthy crops throughout the production cycle
C Use accepted working practices to carry out harvesting and crop storage.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Understand crop species and their products	**A1** Crop plants and their products **A2** Factors determining crop-growing locations	An illustrated report or presentation examining crop species, their products and where they are grown, supported by a portfolio of evidence relating to the recognition of crop plants and their products.
B Establish and maintain healthy crops throughout the production cycle	**B1** The principles of crop establishment **B2** The principles of maintaining healthy crops	A report or presentation examining the production, harvesting and storage of crop species, supported by a portfolio of evidence relating to the maintenance of healthy crops and appropriate remedial actions taken when necessary.
C Use accepted working practices to carry out harvesting and crop storage	**C1** Safe harvesting of crops **C2** The principles of safe storage of crop products	A portfolio of evidence relating to the safe harvesting of crops to meet given objectives, and the safe storage of crop products.

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Content

Learning aim A: Understand crop species and their products

A1 Crop plants and their products

Characteristics and purpose of crop species grown commercially.

- Annual, biennial, perennial crops.
- Identifying crop types, including:
  - cereals, e.g. wheat, barley, oats, rye, triticale
  - oilseeds, e.g. oilseed rape, linseed
  - forage crops, e.g. grass, maize
  - root crops, e.g. sugar beet, fodder beet, potatoes
  - vegetable crops, e.g. brassicas, salad crops
  - top fruit, e.g. apples, plums
  - soft fruit, e.g. strawberries, raspberries
  - legumes and pulses, e.g. peas, beans
  - minor and specialist crops, e.g. miscanthus, borage, canary seed.
- The principles of rotations and cropping sequences.
- The products and by-products derived from different crop types.
- Quality parameters for different types of crop product, e.g. selecting a cultivar for yield, quality and end market.

A2 Factors determining crop-growing locations

- Location of end users, including proximity to markets.
- Transport links.
- Climate, topography and soil type.

Learning aim B: Establish and maintain healthy crops throughout the production cycle

B1 The principles of crop establishment

- Plant propagation from seed and vegetative material.
- Target populations, seed rates and plant spacing.
- Timing of establishment, e.g. autumn or spring.
- Crop establishment systems.
- Cultivation and establishment machinery.
- Seedbed conditions, planting depth and the importance of seed–soil contact.
- Seed dressings.

B2 The principles of maintaining healthy crops

- Recognising healthy and unhealthy crops, e.g. crop growth stages.
- Recognising growth and development stages.
- Control of weeds, pests and diseases, including:
  - cultural, physical, chemical and biological control
  - effect on yield and quality.

- Crop nutrient requirements and calculating plant nutrient requirements, including:
  - major nutrients (nitrogen, phosphate and potassium (potash), sulfur, magnesium)
  - minor and trace elements, e.g. boron, manganese.
- Recognising crop nutrient deficiencies.
- Effect of pH on nutrient availability.
- Effect of waterlogging.
- Sources of plant nutrients, including:
  - organic fertilisers
  - inorganic fertilisers
  - plant residues.
- Use of mapping and remote sensing.
- Specific current relevant legislation and codes of practice/international equivalents relating to crop production.
- Manipulating plant growth, e.g. plant growth regulation, planting timings.
- Ripening and crop maturity.
- Protected cropping, e.g. strawberry production using polytunnels.

Learning aim C: Use accepted working practices to carry out harvesting and crop storage

C1 Safe harvesting of crops

- Pre-harvest management, e.g. desiccation, dehaulming.
- Harvesting methods for combinable crops, fresh crops and manual harvesting.
- Health and safety issues relevant to crop harvesting, including:
  - safe working practices
  - potential consequences of not complying with safe working practices, e.g. injury to self or others, prosecution, invalidation of insurance.
- The use and disposal of by-products and crop waste products, e.g. chopping and spreading, biofuel, animal feed and bedding.

C2 The principles of safe storage of crop products

- Key aspects in safe storage of fresh and dry products:
  - methods of conditioning crops in store and the use of additives
  - control of storage vermin
  - pest and disease control.
- Store hygiene and monitoring.
- In-store climate control, e.g. temperature, humidity.
- The effect of storage on crop quality.
- Long-term storage, short-term storage, central storage, packhouses.
- Safe manual and mechanised grading, cleaning and sorting crops, including packhouses.
- Crop segregation and the reasons why crops are segregated.
- Safe loading, unloading and transport of crops.
- On-farm use of crops and crop by-products.

- Specific health and safety requirements relating to potential hazards and risks in a store environment, e.g. dust, crushing, burial in a crop product, asbestos.
- Use of personal protective equipment (PPE).
- Food safety requirements, e.g. global food assurance schemes.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understanding crop species and their products		
A.P1 Explain identifying characteristics of annual, biennial and perennial crops, and their products. **A.P2** Explain the basic parameters that determine where crops are grown.	**A.M1** Assess the parameters that influence the production, quality and yield of crops.	**A.D1** Evaluate reasons for the production of specified crops in particular locations, and the effect on quality and yield.
Learning aim B: Establish and maintain healthy crops throughout the production cycle		
B.P3 Explain the production cycles required to successfully grow two contrasting crops. **B.P4** Recognise general signs of health and deficiency symptoms in two contrasting crops. **B.P5** Suggest appropriate remedial action to maintain crop health.	**B.M2** Recommend actions to maintain healthy crops throughout the production cycles required to grow two contrasting crops.	**B.D2** Justify appropriate remedial actions taken to maintain the health of crops in given situations.
Learning aim C: Use accepted working practices to carry out harvesting and crop storage		
C.P6 Safely carry out a given crop harvesting task to meet objectives. **C.P7** Safely carry out a given crop monitoring task to meet objectives within given storage facilities.	**C.M3** Relate the results of monitoring to crop harvest conditions and conditioning, grading, sorting and/or cleaning requirements within given storage facilities.	**C.D3** Carry out a monitoring task with a high degree of accuracy, evaluating the impact of growing, harvesting and storage of crops on the quality of the final product.

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of three summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aim: B (B.P3, B.P4, B.P5, B.M2, B.D2)

Learning aim: C (C.P6, C.P7, C.M3, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- growing crops
- crop storage facilities
- a suitable range of equipment and machinery used for crop production
- suitable software used commercially to support crop production (to demonstrate to learners).

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will produce a convincing, in-depth evaluation that fully considers crop production. The evaluation will identify the location of crop production and be clearly focused on the climatic, topographical and soil type influences regarding where crops are grown commercially, with no irrelevancies. Learners will consider thoroughly the quality parameters, the selection of cultivars for specific end uses, the restrictions (if any) imposed by crop rotations, and the use, or disposal, of by-products. They will give specific details relating to the location of end users and transport links, and show accurately how these influence the location of the production of specific crops. The evaluation will be relevant at a local and regional level and supported by reasoned, valid judgements. The evidence will make use of appropriate, accurate agricultural terminology throughout.

For Merit standard, learners will produce a clear, balanced assessment of the factors that affect quality parameters for crop production. Learners will draw on their breadth of understanding of climate, topography and soil type relating to the production of crops. They will demonstrate a clear understanding that certain cultivars are bred for specific end uses, and assess how crops can be grown over a period of time, considering the appropriateness of rotations and cropping sequences. The evidence will be supported by relevant examples of how the location of end users and the available transport links influence where crops are grown. The evidence will make accurate use of appropriate agricultural terminology.

For Pass standard, learners will recognise a range of crops and their products in each definition. They will accurately identify at least 20 crop species across the various crop types listed in the unit content, indicating if the crops recognised are perennial, biennial or annual. Learners will provide a realistic explanation of the reasons for the growth of crops in certain locations. They will select a number of different factors and describe the interconnections, although some of their explanations may be generic. The explanation of the effect of climate, topography and soil type will be limited and may be unbalanced in parts. There may be some minor irrelevancies in the evidence, and some agricultural terminology may be omitted.

Learning aim B

Teachers should note that the application of any plant-protection products or fertiliser is outside the scope of this unit. Across the standard for pass, merit and distinction, it is acceptable for learners to recognise a condition in a crop but give reasons to suggest that a treatment is inappropriate. Reasons could be, for example, that the weed population is too low to warrant control or that a control measure would be more appropriate in the next crop.

For Distinction standard, learners will correctly recognise the symptoms of nutrient deficiencies, weed infestations, pests and diseases in two contrasting crops throughout all stages of the growing season. Learners will fully recognise that poor crop establishment conditions and suboptimal soil pH will have an adverse effect on nutrient availability and plant health. They will draw on their breadth and depth of learning to make well-reasoned, specific recommendations for actions to maintain crop health and explain thoroughly how these recommendations can be justified. The evidence will make use of appropriate agricultural terminology throughout, and will form a well-structured, considered and reasoned response.

For Merit standard, learners will correctly recognise most of the symptoms of nutrient deficiencies, weed infestations, pests and diseases in two contrasting crops, recommending actions to maintain healthy crops throughout the production cycles required to grow two contrasting crops. The justification for any remedial action taken to maintain the health of plants will be clear, appropriate and mostly relevant. However, some of the more subtle interactions will not be recognised, for example the relationship between soil pH and nutrient availability. The evidence will be structured and use appropriate agricultural terminology.

For Pass standard, learners will correctly recognise most of the symptoms of nutrient deficiencies, weed infestations, pests and diseases in two contrasting crops but not necessarily at all stages of the growing season. Learners will make reasonable, generalised suggestions for remedial action to maintain healthy crops. The evidence is, however, likely to be supported by limited use of relevant reasons for the action to be taken. There may be some minor irrelevancies in the evidence and some agricultural terminology may be omitted.

Learning aim C

For Distinction standard, learners will safely harvest (including loading) and monitor given crops. They will undertake monitoring tasks with a very high degree of accuracy and make detailed, insightful suggestions on how crops should be stored. It is likely, but not essential, that learners will relate their suggestions to the harvesting and monitoring tasks they undertook. Learners will relate accurately the effects of growing, harvesting and storage conditions to the quality of the crop and food safety. They will demonstrate robust understanding of the importance of store hygiene in reducing infestations, and evaluate how such infestations can affect crop quality, and, in turn, affect food hygiene. Learners will provide specific, valid reasons that link logically to their views. Learners will make effective judgements on the relative importance of different aspects of crop harvesting and storage, drawing on the results of their monitoring and harvesting activities. The evidence will consistently use relevant and accurate terminology that supports a considered, comprehensive response.

For Merit standard, learners will safely harvest (including loading) and monitor given crops. They will monitor stored crop products to a high degree of accuracy. They will clearly relate harvesting conditions and the results of monitoring to crop storage conditions and make relevant suggestions on how these issues relate to crop quality. Learners will show clear understanding of the importance of store hygiene and give mainly accurate justification for this, including reducing pest, disease or vermin infestation, but not necessarily relating the effects of infestations to long-term food safety. The evidence will make accurate use of appropriate agricultural terminology.

For Pass standard, learners will safely harvest (including loading) and monitor given crops. They will undertake monitoring tasks with an appropriate degree of accuracy but might be limited in scope and might not relate harvesting and conditioning to crop quality. Learners will suggest appropriate on-farm use, unloading, transportation, segregation, conditioning, grading, sorting, or cleaning requirements, as appropriate. They will demonstrate a realistic understanding of the importance of store hygiene but will not necessarily indicate the reasons in any depth or detail. There may be some minor irrelevancies in the evidence, and some agricultural terminology may be omitted.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 18: Crop Handling, Storage and Quality Assurance.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have opportunities to develop the following transferable employability skills in the assessment of this unit:

- research skills
- presentation skills
- written and verbal communication skills.

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Unit 18: Crop Handling, Storage and Quality Assurance

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop skills to handle and store crops through practical tasks and investigative research into quality assurance requirements.

Unit introduction

The efficient harvesting of a crop product is only part of successful crop production; the product also needs to be stored safely and handled without undue damage. This concept applies regardless of whether the crop product is destined for animal feedstuffs or bedding, human consumption, or further processing into pharmaceutical and industrial products.

This unit will enable you to identify appropriate storage and handling systems for a range of crop products and understand how crop products are managed post-harvest. You will learn to recognise the common pests and diseases found in stored products, and explore solutions to these issues, both for crops with a low moisture content, and for those with a higher moisture content that are stored fresh. You will gain knowledge of how crop products are maintained to an acceptable standard to meet the requirements of assurance schemes. This unit will help you to develop skills in using the equipment associated with safe storage and handling of crop products.

This unit will also help you to progress to employment or higher education. As food safety and reduction of food waste become increasingly important, both nationally and globally, the insight you gain from this unit will help you to prepare for and inform you of the important challenges and opportunities that face the agriculture industry in the 21st century.

Learning aims

In this unit you will:

A Investigate processes and systems to maintain dry crop products in storage
B Investigate processes and systems to maintain fresh crop products in storage
C Safely operate machinery and equipment used for handling, cleaning, grading and weighing crops.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate processes and systems to maintain dry crop products in storage	**A1** The storage requirements of dry crop products **A2** The management of dry crop products in storage	An illustrated report or presentation evaluating the storage requirements and systems of two contrasting dry crop products, and the impact on quality.
B Investigate processes and systems to maintain fresh crop products in storage	**B1** The storage requirements of fresh crop products **B2** The storage requirements of forage crop products **B3** The management of fresh crop products in storage	An illustrated report or presentation evaluating the storage requirements and systems of two contrasting fresh crop products, and the impact on quality.
C Safely operate machinery and equipment used for handling, cleaning, grading and weighing crops	**C1** Combinable crop handling equipment **C2** Handling roots, fruit, field vegetables and forage crops	A portfolio of evidence relating to the safe handling of crop products.

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Content

Learning aim A: Investigate processes and systems to maintain dry crop products in storage

The fundamental characteristics of crop storage facilities for dry products destined for either human or animal consumption.

A1 The storage requirements of dry crop products

- Current relevant laws/legislation and codes of practice:
  - laws for crop storage
  - codes of practice, e.g. assurance schemes, assurance scheme requirements
  - specific end-user specifications, e.g. malting, milling, processing
  - crop properties, e.g. angle of repose, airflow properties, bulk density
  - segregation.
- Storage systems:
  - on the farm, including:
    - bins
    - silos
    - on the floor
  - temporary storage
  - long-term storage
  - central stores, including cooperative stores.
- Drying and conditioning:
  - moisture and temperature monitoring, including hand-held instrumentation and automated systems
  - drying systems, including batch drier, continuous flow driers, bulk drying
  - high and low temperature dryer design and operation
  - fans and airflow characteristics
  - sustainable sources of fuel and heat
  - cooling methods.

A2 The management of dry crop products in storage

The fundamental concepts of the maintenance of storage and handling systems for dry crop products.

- Laws/legislation relating to food quality standards.
- Store maintenance, cleanliness and hygiene.
- Safe storage design, height and volume, depth and integrity.
- Health and safety in the store.
- Personal protective equipment (PPE), including prevention of dust inhalation.
- Transport in and around the store.
- Prevention of crop deterioration in store, including control of storage pests and diseases.
- Training and qualifications required to apply rodenticides and plant production products.
- The use and disposal of waste and by-products.
- Record-keeping requirements.
- Staff training.

Learning aim B: Investigate processes and systems to maintain fresh crop products in storage

The fundamental characteristics of crop storage facilities required for fresh products destined for either human or animal consumption.

B1 The storage requirements of fresh crop products

- Types of fresh crop material destined for human consumption:
  - root crops, e.g. potatoes and sugar beet
  - field vegetables, e.g. onions, brassicas, lettuce, vining peas
  - soft fruit, e.g. strawberries, raspberries
  - top fruit, e.g. apples.
- Storage systems for fresh crops:
  - bulk stores
  - container stores
  - box storage
  - temperature-controlled storage
  - importance of time management when dealing with fresh produce
  - control of storage pests and diseases
  - crop assurance scheme requirements
  - record-keeping requirements.

B2 The storage requirements of forage crop products

- Silage and haylage production:
  - methods, e.g. baling, clamps, wrapping, inclusion of inoculants, additives, preservatives
  - measures to control deterioration in quality
  - storage design, e.g. height and volume
  - methods of forage crop storage, e.g. single or mixed crop
  - health and safety, e.g. preventing falls, appropriate PPE, use of additives, inoculants
  - pest and disease control, e.g. rodents and fungal infections.
- Hay and dry forage production:
  - preventing pest and disease ingress
  - storage requirements, including storage height
  - additional treatments, e.g. drying, steaming and soaking
  - health and safety considerations, e.g. preventing inhalation of fungal spores
  - reasons for maintaining dry storage.
- Other forage crops:
  - clamps for root crops, e.g. fodder beet
  - other locally important crops.

B3 The management of fresh crop products in storage

The fundamental concepts of the management of storage and handling systems for fresh crop products.

- Legislation relating to food quality standards.
- Store management:
  - instrumentation and systems control
  - ambient air quality amelioration systems
  - refrigeration and temperature regulation
  - store site management
  - store layout and access
  - store hygiene and its importance
  - food safety considerations and degree of risk, e.g. material that is consumed with no further processing compared to material that is cooked, further processed or fed to animals
  - drainage
  - pest and disease control measures, e.g. rodents and fungal infections
  - the use and disposal of outgrades, waste and by-products.

Learning aim C: Safely operate machinery and equipment used for handling, cleaning, grading and weighing crops

C1 Combinable crop handling equipment

- Loading and unloading machinery:
  - staff training
  - machinery operation, e.g. trailers, chaser bins
  - material handlers
  - elevators, conveyors and augers
  - design considerations.
- Cleaning equipment:
  - staff training
  - dust extraction, e.g. for improved crop quality and health and safety requirements
  - aspirated screens
  - gravity separation
  - specialist sorting machinery, including optical sorters
  - documentation, e.g. crop passports before dispatching a load of product
  - health and safety and PPE requirements when operating and cleaning machinery and equipment.

C2 Handling roots, fruit, field vegetables and forage crops

The techniques required for the safe handling of fresh crop products during loading, unloading and within store.

- Loading and unloading machinery and equipment for roots, fruit and field vegetables:
  - box and bulk systems
  - box fillers
  - box handlers
  - the operation of conveyors and elevators
  - cleaning and grading machinery
  - loading equipment
  - documentation, e.g. requirements for factory receipt for sugar beet.
- Machinery and equipment for grading and packing:
  - store design
  - weighing machines
  - sizing and grading machinery
  - cleaning equipment, including washing and brushing
  - packaging systems, including bagging and shrink wrapping.
- Loading and unloading machinery and equipment for forage crops:
  - trailers and wagons
  - grabs
  - elevators and conveyors
  - material handlers
  - chopper blowers.
- Specific PPE and health and safety requirements when handling roots, fruit, field vegetables and forage crops.

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Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate processes and systems to maintain dry crop products in storage		
A.P1 Explain the basic physical storage requirements for two contrasting dry crop products. **A.P2** Explain the key aspects involved in the management of dry crop products in storage.	**A.M1** Assess the suitability of storage systems for two contrasting dry crop products.	**A.D1** Evaluate the suitability of storage systems for two contrasting dry crop products, relating it to the maintenance of quality.
Learning aim B: Investigate processes and systems to maintain fresh crop products in storage		
B.P3 Explain the basic physical storage requirements for two contrasting fresh crop products. **B.P4** Explain the key aspects involved in the management of fresh crop products in storage.	**B.M2** Assess the suitability of storage systems for two contrasting fresh crop products.	**B.D2** Evaluate the suitability of storage systems for two contrasting fresh crops, relating it to the maintenance of crop product quality.
Learning aim C: Safely operate machinery and equipment used for handling, cleaning, grading and weighing crops		
C.P5 Carry out a combinable crop handling task to meet quality and safety objectives. **C.P6** Carry out a root, fruit, field vegetable or forage crop handling task to meet quality and safety objectives.	**C.M3** Assess the impact of handling of crops on the quality of two contrasting final products.	**C.D3** Evaluate the impact of handling of the crop products on the quality of two final products.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of three summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aim: B (B.P3, B.P4, B.M2, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of crop storage facilities
- a suitable range of equipment and machinery used for crop handling and storage.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will provide a convincing, in-depth evaluation of the effectiveness of the storage of two contrasting dry crop products. The contrast between the crop products could be related to the characteristics of the material or to the end use and, if possible, to different storage systems. The evaluation will consider thoroughly the type of storage, relating this accurately and specifically to the crop product. The evidence will be clearly focused on the parameters used to safely store dry crop products commercially, with no irrelevancies. Learners will comprehensively consider quality parameters, the selection of storage facilities for specific end uses, the restrictions imposed by food safety and the use or disposal of by-products. The evaluation will be relevant at a local and regional level, robustly supported by reasoned, valid judgements. The evidence will make use of appropriate, accurate agricultural terminology throughout.

For Merit standard, learners will provide a clear, balanced assessment of the suitability of storage facilities for two contrasting dry crop products. The contrast between the crop products could be related to the characteristics of the material or to the end use and, if possible, to different storage systems. Learners will draw on their breadth of understanding of the type of storage involved and relate this clearly to the crop product. The evidence will be focused on the parameters used to safely store dry crop products commercially and will be detailed and supported by mostly relevant examples. It will be structured and use appropriate agricultural terminology.

For Pass standard, learners will provide a realistic explanation of the basic storage requirements of two contrasting dry crop products. The contrast between the crop products could be related to the characteristics of the material or to the end use of the material and, if possible, to different storage systems. Learners will explain the management of the crops in storage as well as the machinery required (as listed in the unit content). The evidence will be supported by some relevant examples. Learners will demonstrate realistic but limited knowledge of relevant laws/legislation, codes of practice and assurance schemes, particularly those related to health and safety, and food hygiene. There may be some minor irrelevancies in the evidence and some agricultural terminology may be omitted.

Learning aim B

For Distinction standard, learners will provide a convincing, in-depth evaluation of the effectiveness of the storage of two contrasting fresh crop products, one of which should be a forage crop or product destined for animal feed. The evaluation will thoroughly consider the type of storage, relating this accurately and specifically to the crop product. The evidence will be clearly focused on the parameters used to safely store fresh crop products commercially, with no irrelevancies. Learners will comprehensively consider quality parameters and the selection of storage facilities for specific end uses. They will show robust understanding of the restrictions imposed by food safety, including relating food safety risks to the amount of processing a product undergoes before consumption and the use or disposal of by-products. The evaluation will be relevant at a local and regional level and supported by reasoned, valid judgements. The evidence will make use of appropriate, accurate agricultural terminology throughout.

For Merit standard, learners will provide a clear, balanced assessment of the suitability of storage facilities for two contrasting fresh crop products, one of which should be a forage crop or product destined for animal feed. The contrast between the crop products could be related to the characteristics of the material or to the end use. Learners will relate food safety risks logically to the amount of processing the product undergoes before consumption. They will draw on their breadth of understanding of the type of storage involved and relate this clearly to the crop product. The evidence will be focused on the parameters used to safely store fresh crop products commercially and will be detailed and supported by mostly relevant examples. It will be structured and use appropriate agricultural terminology.

For Pass standard, learners will provide a realistic explanation of the basic storage requirements of two contrasting fresh crop products, one of which should be a forage crop or product destined for animal feed. The contrast between the crop products could be related to the characteristics of the material or to the end use of the material and, if possible, to different storage systems. They will explain the management of the crops in storage as well as the machinery required (as listed in the unit content). The evidence will be supported by some relevant examples. Learners will demonstrate realistic but limited knowledge of relevant laws/legislation, codes of practice and assurance schemes, particularly those related to health and safety, and food hygiene risks. There may be some minor irrelevancies in the evidence and some agricultural terminology may be omitted.

Learning aim C

For Distinction standard, learners will safely undertake crop-handling tasks with a very high degree of accuracy. They will provide in-depth, insightful suggestions regarding the impact of crop handling on crop products, relating their suggestions specifically and accurately to the handling tasks that they undertook. Learners will show in-depth understanding of the importance of safe handling with regard to food hygiene and health and safety. They will use specific, accurate agricultural terminology throughout, and provide specific, valid reasons that link logically to their views.

For Merit standard, learners will safely undertake crop-handling tasks with a high degree of accuracy and make clear, mostly relevant suggestions regarding the impact of crop handling and storage on crop products. They will relate clearly their suggestions to the handling tasks that they undertook. Learners will demonstrate their breadth of knowledge of the importance of safe handling with regard to food hygiene and health and safety. Learners will use accurate agricultural terminology.

For Pass standard, learners will safely carry out at least one given crop-handling task for a combinable crop and a root, fruit field vegetable crop or forage crop (i.e. two crop types in total). The tasks will be undertaken with an appropriate degree of accuracy but might be limited in scope, since learners are not expected to be able to use efficiently all the unloading, transportation, segregation, conditioning, grading, sorting, or cleaning equipment listed in the unit content. Learners will complete all relevant documentation required commercially for the task undertaken and meet all assurance scheme and food safety requirements. Some accurate agricultural terminology will be used.

Links to other units

This unit links to *Unit 17: Crop Production*.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have opportunities to develop the following transferable skills in the assessment of this unit:

- research skills
- presentation skills
- written and verbal communication skills.

Unit 19: Combinable Crop Production and Processing

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop skills and knowledge in the production and processing of combinable crops throughout the whole cycle, including requirements for processing produce for market.

Unit introduction

The production and processing of combinable crops is an area that has been extensively developed by technology in recent years. Areas that are suitable for growing combinable crops, can often produce high yields.

In this unit, you will develop the skills and knowledge required to produce combinable crops frequently destined for the human consumption market. As such, these commodities must be produced to the highest food quality standards as both quality and traceability are increasingly important matters of public interest. This unit will help you develop a broad understanding of how combinable crops are produced and processed. You will investigate combinable crop production requirements, following the crops from the field through to processing. You will also undertake husbandry tasks associated with the production of combinable crops.

This unit will help you to progress to employment in the sector in roles such as unit manager, crop technician or trials officer or to progress to higher education onto courses such as land management or agricultural management. The insight gained from this unit will help to inform and prepare you for the challenges and opportunities facing the agriculture industry in the 21st century in relation to food safety concerns.

Learning aims

In this unit you will:

A Investigate production requirements for combinable crops

B Explore the processing and quality requirements for marketing combinable crops

C Carry out preparation and cultivation tasks related to combinable crops.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate production requirements for combinable crops	**A1** Production requirements **A2** Crop choice and establishment techniques **A3** The role of legislation and codes of practice	A report evaluating the production requirements for combinable crops, including legal requirements, varietal choices and use of establishment techniques.
B Explore the processing and quality requirements for marketing combinable crops	**B1** Processing requirements for combinable crops **B2** Quality requirements for marketing combinable crops	A report or presentation on the processing and marketing of combinable crops. A practical portfolio relating to the completion of preparation and cultivation tasks for combinable crop production.
C Carry out preparation and cultivation tasks related to combinable crops	**C1** General husbandry tasks **C2** Fertiliser application **C3** Weed, pest and disease control	

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Content

Learning aim A: Investigate production requirements for combinable crops

A1 Production requirements

- Role of location, climate, topography and place in rotation in choice of crop and crop types.
- Effects of weather, e.g. rain, wind, sunshine, frost, snow.
- Relationship between soil type, soil pH, soil structure and crop growth.
- Soil indices.
- Environmental considerations relevant to combinable crop production.
- Key husbandry requirements:
  - soil preparation, drainage requirements
  - cultivations, timings and techniques
  - prevention and rectification of soil management issues, e.g. erosion, compaction and soil pans
  - establishment techniques, including drilling and planting method.
- Key factors relating to use of seeds, including:
  - seed quality and vigour
  - seed treatments
  - certified seed
  - use of home-saved seed
  - seed rate calculations using thousand grain weight (TGW) or thousand seed rate (TSW)
  - seed spacing
  - autumn- and spring-sown crops
  - reasons for growing crops at different times of year.
- Potential end uses of crop:
  - cultivar choice and recommended list interpretation, including yield and resistance to disease
  - market specifications, including malting barley, milling wheat, distilling, animal feed
  - reasons for rejection, including moisture and damage, e.g. bruchid beetle in beans, mycotoxins in cereals, excessive admixture.

A2 Crop choice and establishment techniques

- Cereals, e.g. wheat, barley, oats, rye, oilseed rape, durum wheat, triticale.
- Pulses, e.g. peas, beans, linseed.
- Minor and alternative crops, e.g. sunflowers, lupins, borage, evening primrose oil, hemp.
- Seedbed requirements and preparation, including beds and ridges.
- Seed and plant selection, cultivar considerations.
- Other pre-planting requirements, including seed dressings, machinery selection for planting and drilling, plant spacing.
- Manure and fertiliser requirements, including health and safety considerations.
- Weed, pest and disease control.
- Environmental considerations in relation to the control of weeds, pests and disease.

A3 The role of legislation and codes of practice

- Legislation/law for health and safety at work.
- Nitrate vulnerable zones, local environmental risk assessment procedures, safe use of chemicals, biosecurity, codes of practice, safe working practices.
- Operator certification requirements for use of equipment and materials relevant to combinable crop production.

Learning aim B: Explore the processing and quality requirements for marketing combinable crops

B1 Processing requirements for combinable crops

- Harvesting:
  - importance of timing, schedules and time management
  - signs of crop ripeness and maturity
  - crop size and quality
  - problems associated with overripe/underripe crops, grain or seed size and shape
  - machinery and labour organisation, including seasonal requirements for staff
  - crop yields, e.g. tonnes per hectare, monitoring output
  - minimising crop damage, e.g. warming, pest and vermin damage.
- Storage:
  - safe storage of combinable crops according to moisture content
  - cleaning and removal of weeds, seeds and debris
  - types of store, including temporary, permanent, on floor, bins, central stores
  - climate control in store, including ventilation, moisture
  - disease prevention, hot spots, grain- and seed- sprouting prevention methods
  - crop storage monitoring and recording of temperatures, ventilation, pest and vermin damage.
- End use of crops:
  - human consumption, animal feed, bird seed
  - food manufacturing, processed food, ready meals, malting, bread making and biscuits
  - pharmaceutical use and medicinal properties of crops
  - industrial use, e.g. liquids, inks and oils.

B2 Quality requirements for marketing combinable crops

- Market specifications, including grain or seed size, boldness, bushel weight, quality requirements.
- Contractual specifications:
  - processor, including impact on ability to use in processing, moisture content, nitrogen content, protein content, oil content, human consumption end use, e.g. ready meals, dried food products
  - manufacturer, including impact on end use and issues with rejected samples that do not meet quality requirements
  - seed, including impact on suitability for use, variety, being free from disease, using variety and germination test results

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  - food standards and traceability, including the importance of being able to track the food production process
  - quality assurance schemes, including grower confirmation that commodities have been produced according to required standards and are fit for sale at that point.
- Using grading machines.
- Transporting combinable crops from field to farm, farm to store, store to sale.
- Production targets:
  - inputs, including cost of seed, fertiliser, chemicals, levies and charges
  - outputs, including price per tonne, premiums, bonuses and deductions
  - gross margins.
- Biosecurity, including grower responsibility for appropriate waste disposal methods, e.g. for feed, small grain or seed samples, plastic and bags.

Learning aim C: Carry out preparation and cultivation tasks related to combinable crops

C1 General husbandry tasks

- Importance of timing, schedules and time management in carrying out husbandry activities.
- Soil and seedbed preparation and cultivation techniques.
- Date of drilling or planting and its effect on growth, yield and quality.
- Crop protection methods against extreme weather, e.g. flooding, high winds, extreme heat, extreme cold.
- Monitoring growth and development of combinable crops.
- Harvesting operations.
- Appropriate disposal of waste, e.g. seed, bags, chemicals.
- Consideration of biosecurity and sustainable waste disposal practices.
- Cultivation equipment, including primary and secondary cultivations, minimum tillage, no-till methods.
- Cultivating settings, width of machine and depth of cultivation, including deep and shallow working depths.

C2 Fertiliser application

- Sources of fertiliser available, including organic and inorganic types.
- Timing of fertiliser application.
- Importance of understanding combinable crop growth stages in relation to fertiliser application.
- Importance of applying correct amount of fertiliser and the consequences of not applying correct amount.
- Methods of calculating fertiliser rates, yield mapping, N-Sensor data, variable rate application, Global Positioning System (GPS) mapping, computer programs, e.g. PLANET.
- Application methods, e.g. manure spreader, fertiliser spreader, liquid sprayer.
- Examples of solid fertiliser, including farmyard manure, granular fertiliser.
- Examples of liquid fertilisers, including:
  - straight liquid, e.g. nitrogen only
  - blended fertiliser, e.g. nitrogen and other suspensions.

C3 Weeds, pest and disease control

- Identifying common weeds, pests and diseases of combinable crops.
- Recommending control measures to address weeds, pests and diseases.
- Advantages and disadvantages of control measures to address weeds, pests and disease.
- Specific health and safety measures associated with weed, pest and disease control, including:
  - local environmental risk assessment for pesticides
  - other aspects of risk assessments, e.g. use of personal protective equipment (PPE).
- Interpreting agronomist recommendations.

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Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate production requirements for combinable crops		
A.P1 Explain the key production requirements of combinable crops, including legal requirements. **A.P2** Explain the role of variety choices and techniques in establishing combinable crops.	**A.M1** Assess the impact of production requirements, including legal requirements, on combinable crop production. **A.M2** Assess the significance of variety choices and techniques in establishing combinable crops.	**A.D1** Evaluate the importance of production requirements, variety choices, techniques and legal requirements in establishing combinable crops.
Learning aim B: Explore the processing and quality requirements for marketing combinable crops		
B.P3 Explain the processing requirements of common combinable crops. **B.P4** Explain the key marketing requirements of common combinable crops.	**B.M3** Assess the quality specifications to be met in processing and marketing combinable crops.	**B.D2** Evaluate the impact of quality specifications on the processing and marketing of combinable crops.
Learning aim C: Carry out preparation and cultivation tasks related to combinable crops		
C.P5 Competently demonstrate husbandry techniques to prepare sites for combinable crop production. **C.P6** Competently demonstrate cultivation methods to prepare sites for combinable crop production.	**C.M4** Efficiently demonstrate husbandry techniques and cultivation methods to prepare sites for combinable crop production.	**C.D3** Demonstrate, with a high degree of accuracy, husbandry techniques and cultivation methods to prepare sites for combinable crop production.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M3, C.M4, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of growing combinable crops
- an appropriate range of safe and serviceable machinery used in preparing and cultivating sites
- farm records, in particular input costs.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will produce an in-depth, convincing investigation of production requirements for three combinable crops. They will make comprehensive and accurate connections between the fundamental requirements for successful combinable production, including the climate and soil type preferences dictated by the crop. Learners will provide a detailed account of all aspects of production requirements, including accurate understanding of the husbandry requirements in preparing for the establishment of the crop. They will show breadth and depth of understanding of crop choice and establishment techniques, giving consistently valid views on how these impact on overall crop production success. Learners will also give detailed, insightful consideration of the impact of legislation on combinable production. They will demonstrate breadth and depth of understanding in all areas, using specific agricultural terminology accurately throughout.

For Merit standard, learners will make clear, appropriate judgements in their assessment of the production requirements for three combinable crops. They will make mainly relevant connections between the fundamental requirements for the successful production of combinable crops and include mostly valid detail regarding the requirements of the climate and soil type preferred by the crop. Learners will make valid justifications of the role of husbandry requirements in preparing for the establishment of the crops. They will show some breadth and depth of understanding of crop choice and establishment techniques, giving mostly relevant views on how these impact on overall crop production success. Learners will demonstrate a breadth of understanding regarding the impact of legislation on combinable production, providing mainly relevant reasons for their views. Learners will produce evidence that makes mainly accurate use of agricultural terminology.

For Pass standard, learners will provide a limited but realistic account of the production requirements of three combinable crops. They will make some basic, relevant connections between the key factors required for combinable crop production and demonstrate a basic understanding of the effects of climate and soil type on crop production, with some irrelevancies. Learners will show a realistic awareness of the establishment needs of the crop but the evidence may be unbalanced or limited in scope. They will show limited understanding of crop choice and establishment techniques, giving some relevant but undeveloped explanations of how these impact on overall crop production success. Learners will provide a limited account of the impact of legislation on combinable production, showing a realistic understanding of most of the key aspects but lacking in examples or reasons that link logically to their views. Learners will make use of some relevant agricultural terminology, though this may be limited and inaccurate in parts.

Learning aims B and C

In order to achieve learning aims B and C, learners are required to carry out husbandry tasks to demonstrate the practical skills of husbandry. Teachers should ensure the crops chosen by learners provide sufficient scope for them to fully complete the assessments.

For Distinction standard, learners will provide an in-depth evaluation of the processing of two combinable crops. They will consider thoroughly all the relevant stages, from when the crops are marketed on the farm and through the relevant processing plant. Learners' evidence will be comprehensive and include an accurate breakdown of the processing of combinable crops. They will also include information on the harvesting, storing and processing of crops and make consistently valid, logical links between crop quality requirements and how these affect the end use of the product. Learners will give in-depth consideration to the importance of marketing, including insightful, accurate references to the role of specifications, finances and production targets. They will link this logically to the financial impact when quality specifications are not met, along with costs associated with the production of combinable crops.

Learners will demonstrate husbandry techniques and cultivation methods for combinable crops with a high degree of accuracy. They will carry out the tasks confidently and show initiative in doing so, within the limits of their responsibility. Learners will fully complete the required tasks. In doing so, they will comply at all times with health and safety requirements, assessing risks and minimising injury to self and others, selecting and using all equipment appropriately and with a high degree of accuracy, reflecting best practice in industry. Learners will complete comprehensive and accurate records as appropriate to the work undertaken. They will demonstrate detailed knowledge of fertiliser application and crop protection methods as well as weed, pest and disease identification and control, making consistently logical judgements that show they understand the importance of these husbandry tasks in relation to overall crop health. Learners will use specific agricultural terminology and be accurate throughout.

For Merit standard, learners will provide clear, mostly relevant judgements on the processing of two combinable crops, from when the crops are marketed on the farm and through the relevant processing plant. They will show breadth and some depth of understanding, providing clear understanding of the harvesting, storing and processing of crops and making mostly valid justifications between crop quality requirements and how these affect the end use of the product. Learners will give a clear, detailed assessment of marketing, including mostly relevant references to the role of finances, specifications and production targets. They will make some relevant references to the financial implications of not meeting quality specifications.

Learners will efficiently carry out husbandry techniques and cultivation methods for combinable crops, showing some initiative within the limits of their responsibility. They will complete these tasks appropriately, complying with health and safety requirements and assessing the risks. Learners will keep records, as appropriate to the tasks and with sufficient detail, so it is clear what has been carried out. They will demonstrate a clear understanding of fertiliser application and crop protection methods as well as weed, pest and disease identification. Learners will make mostly logical judgements that show they understand the importance of these husbandry tasks in relation to overall crop health. Learners' evidence will show mostly accurate use of specific agricultural terminology.

For Pass standard, learners will provide a limited explanation of the processing of two combinable crops, from when the crops are marketed on the farm and through the relevant processing plant. They will provide basic detail on crop harvesting, storing and processing of crops, highlighting the most obvious aspects of combinable crop production and associated requirements. Learners will make basic, realistic links between crop quality requirements and how these affect the end use of the product but the evidence will be unsupported or superficial in parts. Learners will give a realistic, basic explanation of marketing, including some appropriate but undeveloped references to the role of specifications, finances and production targets.

Learners will carry out practical husbandry tasks for combinable crops, completing them appropriately but showing little initiative within the limits of their responsibility. They will complete the required tasks safely and adhere to health and safety requirements but show limited knowledge of associated risks and their controls. Learners will show some breadth of understanding of fertiliser application and crop protection methods as well as weed, pest and disease identification. They will make decisions that show a realistic but undeveloped understanding of the importance of these husbandry tasks in relation to overall crop health. They will show an appropriate awareness of the need to keep the appropriate records, providing the key information. Learners' evidence will show some use of agricultural terminology though there may be omissions.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 17: Crop Production
- Unit 18: Crop Handling, Storage and Quality Assurance.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- visits to end-user premises
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research and presentation skills
- analysis skills when processing and marketing produce
- independent working practices when working outdoors.

Unit 20: Grass and Forage Crop Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners investigate the production of commercially produced forage crops, carry out forage crop grazing management tasks, and examine life cycles and conservation of forage crops.

Unit introduction

The cultivation of grass and forage crops can make an important contribution to livestock feeding in many land-based situations. The use of grass and forage crops can also benefit other enterprises as part of a rotation, for example fixing nitrogen and allowing spring cultivations.

In this unit, you will investigate in detail crops of local importance as well as the wide range of grass and forage crops produced. You will investigate the husbandry requirements of a range of forage crops, their botanical and agronomic characteristics, harvesting and storage, together with their nutritional value. You will consider wider agronomic and environmental issues, such as the use of grazing animals for habitat management. You will also consider the husbandry of forage crops, and study their establishment, use and management. This unit will give you the opportunity to undertake practical grazing management tasks and to make relevant recommendations for a forage crop. You will research the harvesting, storage and utilisation of forage crops by a range of livestock species, developing a sound understanding of yield and nutritive content as methods of evaluating the potential feed value of forage crops for feeding livestock.

This unit will help you to progress to employment in the sector in roles such as unit manager, crop technician or trials officer or to progress to higher education onto courses such as land management or agricultural management. The insight gained from this unit will help to inform and prepare you for the challenges and opportunities facing the agriculture industry in the 21st century as food security becomes increasingly important both nationally and globally.

Learning aims

In this unit you will:

A Investigate requirements for the growth and development of commercially produced forage crops

B Undertake tasks to maintain healthy forage crops for grazing

C Investigate the conservation of forage crops for animal feed.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate requirements for the growth and development of commercially produced forage crops	**A1** Key biological and physical factors in the growth and development of forage crops **A2** Establishing forage crops **A3** The digestibility and nutrient value of grazed forage crops	An illustrated report or presentation examining forage crop production and relating this to plant growth and development.
B Undertake tasks to maintain healthy forage crops for grazing	**B1** Maintaining healthy forage crop production throughout the grazing season **B2** Key procedures and issues associated with managing forage crops during the grazing season **B3** Laws/legislation and codes of practice	A report and/or presentation examining the production of forage crops for grazing and conservation, supported by a portfolio of evidence relating to the management of forage crops during the grazing season.
C Investigate the conservation of forage crops for animal feed	**C1** Common systems for forage crop conservation **C2** The digestibility and nutrient value of conserved forage crops **C3** Processes for harvesting and storing conserved forage crops	

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Content

Learning aim A: Investigate requirements for the growth and development of commercially produced forage crops

A1 Key biological and physical factors in the growth and development of forage crops

- Key terminology associated with forage crop growth and development, e.g. rough grassland, permanent grassland, pasture, meadow, ley, sward, turf, tillering, catch crops.
- Life cycles of forage crops, including annual, biennial and perennial, annual grass growth curve.
- Plant growth and development, including the differences between vegetative and reproductive growth.
- The relationship between photosynthesis and carbohydrate production.
- Effect of environmental factors on forage crops, including day length, daylight, temperature and rainfall.
- Effect of physical factors on the growth of forage crops, e.g. slope, aspect, rainfall, soil type, soil structure, pH.
- Agronomic factors influencing the growth and development of key forage crop species.

A2 Establishing forage crops

- Site preparation and seedbed requirements for different types of forage crop, e.g. cultivations.
- Crop species, cultivars and seed mixtures for different purposes, including grazing and conservation.
- Germination and emergence in different types of forage crop, e.g. annual, biennial, perennial.
- Establishment techniques in different types of forage crop, e.g. annual, biennial, perennial, e.g. drilling, broadcasting, slot seeding, overseeding, undersowing.
- Weed, pest and disease problems in newly established crops.
- Key considerations when planning a rotation, including forage crops.

A3 The digestibility and nutrient value of grazed forage crops

- Nutrient value of forage crops, including differences between species and changes throughout the grazing season.
- Palatability of forage for grazing livestock.

Learning aim B: Undertake tasks to maintain healthy forage crops for grazing

B1 Maintaining healthy forage crop production throughout the grazing season

- Nutrition requirements, e.g. macronutrients (nitrogen, phosphate, potassium), minor nutrients (molybdenum, magnesium etc.) and pH.
- Nutrient requirements, timing and application.
- Maintenance and improvement operations, e.g. rolling, harrowing, topping, drainage, aeration, reseeding.

- Repairing damaged swards and minimising poaching.
- Identifying weeds, pests and diseases of forage crops.
- Recommending control measures to address weed, pest and disease.
- Equipment used for applying plant protection products and fertiliser.
- Specific health and safety measures associated with grazing management, e.g. use of personal protective equipment (PPE).
- Importance of schedules and time management when managing crop maintenance activities.

B2 Key procedures and issues associated with managing forage crops during the grazing season

- Avoiding undergrazing, overgrazing and scrub development.
- Grazing regimes and procedures, e.g. rotational grazing.
- Fencing, including temporary fencing.
- Monitoring grazed forage crops.
- The management of grazing animals for nature conservation purposes, including sustainable practices.
- Complying with requirements of conservation management plans.
- Animal welfare requirements, e.g. nutrient application, timings, poisonous plants, biosecurity.
- Public access and livestock worrying.
- PPE and health and safety issues.

B3 Laws/legislation and codes of practice

- Legislation, relevant codes of practice and environmental considerations, e.g. nitrate vulnerable zones, local environmental risk assessment procedures, safe use of chemicals, biosecurity, codes of practice, safe working practices.
- Specific health and safety requirements associated with forage crop production.
- Operator certification requirements for use of equipment and materials relevant to forage crop production.
- Quality assurance, e.g. food assurance schemes.

Learning aim C: Investigate the conservation of forage crops for animal feed

C1 Common systems for forage crop conservation

- Silage, e.g. clamped, wrapped.
- Haylage.
- Hay.
- Dehydration, e.g. dried grass nuts.
- Factors that influence silage and haylage production:
  - sugar concentration
  - pH adjustment
  - additives
  - wilting.

C2 The digestibility and nutrient value of conserved forage crops

- Sampling methods.
- Assessment of conserved forage, e.g. colour, texture, taste, smell.
- Importance of dry matter.
- Recognising the quality of dry matter.
- Interpreting results of routine laboratory analysis, e.g. ammonia (% total N), D value, metabolisable energy (ME), ash, protein, nitrogen fractions, lactic acid, acetic acid, butyric acid, ethanol.
- The potential effects of poisonous plants, e.g. ragwort.
- Suitability of forage for specific classes of livestock.

C3 Processes for harvesting and storing conserved forage crops

The techniques required for the safe handling of conserved forage crops during loading, within store and feeding livestock.

- Silage production:
  - cutting regimes, e.g. 1st, 2nd and 3rd cuts
  - methods, e.g. clamps, wrapping
  - measures to control deterioration, e.g. excluding oxygen, preventing contamination
  - the length that the crop is chopped
  - single or mixed crop storage
  - health and safety, e.g. falls, and appropriate PPE
  - the importance of pest and disease control, e.g. rodent damage allowing air ingress.
- Hay production.
- Drying methods:
  - preventing pest and disease ingress
  - additional treatments, e.g. steaming and soaking
  - health and safety, e.g. inhaling fungal spores
  - maintaining dry storage.
- Other forage crops:
  - clamps for root crops, e.g. fodder beet
  - other locally important crops.
- Machinery used for harvesting forage crops.
- Machinery operation, e.g. mowers, foragers, balers, wrappers.
- Loading and unloading machinery and equipment for handling forage crops:
  - adaptions to trailers and wagons for forage crops
  - material handlers, including attachments used specifically for handling forage
  - grabs
  - elevators and conveyors
  - chopper blowers
  - other specialist forage crop machinery, e.g. for handling root crops produced for animal feed.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate requirements for the growth and development of commercially produced forage crops		
A.P1 Contrast the life cycles of annual, biennial and perennial crops. **A.P2** Explain the biological and physical factors influencing the growth and development of contrasting forage crops.	**A.M1** Assess the growth and development characteristics of contrasting forage crops.	**A.D1** Evaluate how biological and physical factors influence forage crop growth and development.
Learning aim B: Undertake tasks to maintain healthy forage crops for grazing		
B.P3 Explain possible remedial actions to maintain crop health for contrasting forage crops throughout the grazing season. **B.P4** Competently carry out grazing management tasks to meet objectives and legislative requirements.	**B.M2** Recommend remedial actions to maintain crop health for contrasting forage crops throughout the grazing season. **B.M3** Efficiently carry out grazing management tasks to meet objectives and legislative requirements.	**B.D2** Carry out grazing management tasks with a high degree of accuracy, including justification of remedial actions to maintain the health of contrasting forage crops.
Learning aim C: Investigate the conservation of forage crops for animal feed		
C.P5 Compare contrasting methods of conserving forage crops used to meet quality requirements. **C.P6** Explain possible actions arising from the results of laboratory analysis of conserved forage crops.	**C.M4** Assess the effect of contrasting conservation methods on forage crop quality. **C.M5** Assess the implications of the results of laboratory analysis of conserved forage crops.	**C.D3** Evaluate the results of the analysis of contrasting conserved forage types, relating the results to the conservation methods used.

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, B.M3, C.M4, C.M5, B.D2, C.D3).

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- growing forage crops and forage crop storage facilities
- a suitable range of equipment and machinery used for forage crop production
- stored forage and appropriate laboratory analysis for the stored forage
- suitable software used commercially to support crop production and forage analysis, available for demonstration to learners.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will produce a convincing, in-depth evaluation that fully considers the forage crop production cycle for three contrasting forage crops. The evaluation will accurately identify how life cycle, establishment, climate, topography and soil type influence the growth and development of three contrasting forage crops, with no irrelevancies. Learners will demonstrate depth and breadth of understanding to thoroughly investigate quality parameters, including digestibility. They will show an in-depth understanding of any other relevant factors, such as the selection of cultivars and species, and the restrictions (if any) imposed by crop rotations. Learners' evaluations will be relevant at a local and regional level, and will be supported by reasoned, valid judgements that link logically and specifically to their views. The evidence will make use of appropriate, accurate agricultural terminology throughout.

For Merit standard, learners will produce a clear, balanced assessment of the factors that affect forage crop production. Learners will draw on their breadth of understanding of life cycle, establishment, climate, topography and soil type relating to the growth and development of three contrasting forage crops. They will demonstrate clear understanding that certain cultivars and seed mixtures have been developed for specific end uses. Learners will make mostly valid references to digestibility and other quality parameters and the restrictions (if any) imposed by crop rotations. The evidence will be detailed and supported by mostly relevant examples. It will be structured and use appropriate agricultural terminology.

For Pass standard, learners will recognise a range of forage crops within each definition. As a minimum, learners will be required to identify accurately three annual, three biennial and three perennial forage crop species and make basic, realistic comparisons between them. Learners will give a basic description of the techniques required to establish forage crops. They will provide a realistic but limited explanation of growth and development for three contrasting forage crops. They will select different physical and biological factors, explaining the interconnections in a mostly generalised way. Their explanation of the effect of climate, topography and soil type will be realistic but limited, and may be unbalanced in parts. Learners will make basic, undeveloped references to the importance of digestibility. They will make some appropriate references to other quality parameters and the restrictions (if any) imposed by crop rotations. There may be some minor irrelevancies in the evidence that will show some use of relevant terminology but there may be omissions.

Learning aims B and C

For Distinction standard, learners will produce a convincing, in-depth justification of the effectiveness of the remedial actions required to maintain the health of two contrasting forage crops throughout the grazing season. The evidence will be clearly focused on the parameters used commercially to graze forage crops safely, with no irrelevancies. Learners will demonstrate a detailed knowledge of the nutrients and plant protection required to maintain forage crops. Learners will draw on breadth and depth of knowledge to show a robust understanding of the restrictions imposed on forage crop production by legislation, animal health and welfare (including grass staggers), health and safety, environmental protection and operator certification requirements. Learners' justifications will be relevant at a local and regional level, robustly supported by reasoned, valid judgements.

Learners will carry out grazing management tasks with a very high degree of accuracy to fully meet the objectives of a given brief. The grazing management tasks will include monitoring the forage crops to determine, with a high degree of accuracy, the suitability for grazing at the time of the assessment, and detailed, insightful recommendations for any present or future remedial action. The evidence could take the form of, and be of an equivalent standard to, an agronomist's report. Learners will carry out the practical tasks confidently, and show a high degree of initiative within the limits of their responsibility. Learners will complete comprehensive and accurate records as appropriate to the work undertaken.

Learners will provide an in-depth, convincing interpretation of the results of forage analysis. The evidence will draw on breadth and depth of knowledge to show a high degree of accuracy in the interpretation of the data analysis and possible actions that would result from the analysis. Learners will show a robust understanding of how two contrasting forage conservation methods can influence the quality of forage, and how this is reflected in the analysis. They will use specific, accurate agricultural terminology throughout, and consistently provide specific, valid reasons that link logically to their views.

For Merit standard, learners will provide clear, balanced recommendations for the suitability of any remedial actions required to maintain the health of two contrasting forage crops throughout the grazing season. Learners will draw on their breadth of understanding regarding the parameters used to safely graze forage crops commercially. Learners will demonstrate mostly accurate knowledge of the nutrients and plant protection required to maintain forage crops. Learners will show breadth of understanding of the restrictions imposed on forage crop production by legislation, animal health and welfare (including grass staggers), health and safety, environmental protection and operator certification requirements. Learners' recommendations will be relevant at a local and regional level, supported by mostly valid judgements.

Learners will efficiently carry out grazing management tasks to meet given objectives. They will demonstrate mostly relevant and accurate knowledge and skills. The grazing management tasks will include monitoring the forage crops to determine the suitability for grazing at the time of the assessment, and mostly relevant recommendations for any present or future remedial action. The evidence could take the form of a basic agronomist's report. Learners will carry out the practical tasks competently, and show some initiative within the limits of their responsibility. Learners will keep records as appropriate to the tasks, with sufficient detail so it is clear what has been carried out.

Learners will give a balanced, clear assessment of the potential impact of contrasting conservation methods on forage crop quality. They will explain clearly the machinery and equipment required to conserve crops using two contrasting methods. Learners will assess how the effect of the machinery and conservation methods used can influence the quality of the forage produced. Learners will provide a detailed, mostly valid interpretation of forage quality, indicating its suitability as part of a ration for specific classes of livestock, and consider how the example(s) given compares with other forages. However, learners will not be able to make the connection between the method used to harvest and store the crop, and its quality. Learners will provide a clear and mostly accurate assessment of the implications of the feed value from the results of laboratory analysis of conserved forage crops and make some valid suggestions for actions following on from the analysis, for example for which class of livestock would the forage be suitable. They will use specific, accurate agricultural terminology and provide mostly valid reasons, which link logically to their views.

For Pass standard, learners will provide realistic but limited suggestions for the remedial actions required to maintain the health of two contrasting forage crops throughout the grazing season. The contrast between the crops could be related to the characteristics of the soil type, drainage and machinery required. Learners' explanations will be appropriate but lack the depth required to show specific links between related factors. Learners will safely carry out two given grazing management tasks. These tasks will be undertaken with an appropriate degree of accuracy. The grazing management tasks will include monitoring the forage crops to determine broadly the suitability for grazing at the time of the assessment, and basic recommendations for any present or future remedial action. The evidence could take the form of a verbal or written report. Learners will carry out the practical tasks safely, but show little initiative within the limits of their responsibility. They will demonstrate basic knowledge of the nutrients and plant protection required to maintain forage crops, and the evidence will be generic, or limited in scope. Learners will show that they can carry out tasks with appropriate regard for health and safety and legislative requirements. They will show an appropriate awareness of the need to keep the appropriate records, providing the key information.

Learners will explain two contrasting methods of conserving forage crops. They will give a realistic, but limited, explanation of the key quality requirements for the crops conserved by these methods and any differences between them. Learners will demonstrate a basic knowledge of the equipment and machinery required to conserve two contrasting forage crops.

Learners will give realistic, but limited, suggestions for possible actions arising from the results of laboratory analysis of conserved forage crops, such as the suitability of the forage as part of a ration for different classes of livestock. Learners' evidence will use some specific, accurate agricultural terminology, and provide some valid reasons that link appropriately to their views. There may be some minor irrelevancies in the evidence, and some agricultural terminology may be omitted.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 17: Crop Production
- Unit 18: Crop Handling, Storage and Quality Assurance.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research and presentation skills
- analysis skills when processing and marketing produce
- independent working practices when working outdoors.

Unit 21: Root Crop and Field Vegetable Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop skills and knowledge in root crop and field vegetable production throughout the whole cycle, including requirements for processing produce for market.

Unit introduction

The production of root crops and field vegetables has become a specialist area of food production as not all areas are suitable for growing and producing top-quality root crops and field vegetables. Many crop types require sought-after, specific skills and knowledge in order to be managed effectively.

In this unit, you will develop the skills and knowledge required to produce commodities that are frequently destined for the human consumption market. As such, these crops and vegetables must meet the highest food quality standards as both quality and traceability are increasingly important matters of public interest. This unit will help you to develop a sound understanding of how crops enter the human food chain. You will investigate fundamental root crop production requirements, following the product from the field through to processing. You will also undertake husbandry tasks associated with the production of root crops and field vegetables.

This unit will help you to progress to employment in the sector in roles such as unit manager, crop technician or trials officer or to progress to higher education onto courses such as land management or agricultural management. The insight gained from this unit will help to prepare you for the future challenges and opportunities facing the agriculture industry in the 21st century in relation to food safety concerns.

Learning aims

In this unit you will:

A Investigate production and husbandry requirements for root crops and field vegetables

B Explore the processing and quality requirements for marketing root crops and field vegetables

C Carry out husbandry tasks related to root crops and field vegetables.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate production and husbandry requirements for root crops and field vegetables	**A1** Key biological and physical requirements for production **A2** Key husbandry requirements **A3** The role of legislation and codes of practice	A report evaluating the production and husbandry requirements of producing root crops and field vegetables.
B Explore the processing and quality requirements for marketing root crops and field vegetables	**B1** Processing requirements for root crops and field vegetables **B2** Quality requirements for marketing root crops and field vegetables	A report or presentation on how root crops and field vegetables are moved from farms and processed and marketed. A practical portfolio relating to the completion of husbandry tasks for root crops and field vegetables.
C Carry out husbandry tasks related to root crops and field vegetables	**C1** General husbandry tasks **C2** Fertiliser application **C3** Weed, pest and disease control	

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Content

Learning aim A: Investigate production and husbandry requirements for root crops and field vegetables

A1 Key biological and physical requirements for production

- Climate in a country, climatic regions and the effects of climate on root crops and field vegetables.
- Effects of topography and aspect.
- Effects of weather, e.g. rain, wind, sunshine, frost, snow.
- Relationship between soil type, soil pH, soil structure and crop growth.
- Soil indices.
- Environmental considerations relevant to root crop and field vegetable production.

A2 Key husbandry requirements

- Rotation considerations.
- Seedbed requirements and preparation, including beds and ridges.
- Seed and plant selection and varietal considerations.
- Other pre-planting requirements, including seed dressings, machinery selection for planting and drilling, plant spacing.
- Manure and fertiliser requirements, including health and safety considerations.
- Weed, pest and disease control.
- Environmental considerations in relation to control of weeds, pests and disease.
- Additional root crop and field vegetable requirements, including irrigation, plastic film, polytunnels, glasshouses.

A3 The role of legislation and codes of practice

- Legislation/law for health and safety at work.
- Nitrate vulnerable zones, local environmental risk assessment procedures, safe use of chemicals, biosecurity, codes of practice, safe working practices.
- Operator certification requirements for use of equipment and materials relevant to root crop and field vegetable production.

Learning aim B: Explore the processing and quality requirements for marketing root crops and field vegetables

B1 Processing requirements for root crops and field vegetables

- Harvesting:
  - importance of timing, schedules and time management
  - signs of crop ripeness and maturity
  - crop size and quality
  - problems associated with overripe/underripe crops, tuber size and shape
  - machinery and labour organisation, including seasonal requirements for staff
  - crop yields, e.g. tonnes per hectare, monitoring output
  - minimising crop damage, e.g. cutting, bruising.

- Storage:
  - types of store, including temporary, permanent, clamp, cold store, on floor, box
  - climate control in store, including frost, ventilation, moisture, insulation
  - disease prevention and sprouting prevention methods
  - crop storage monitoring and recording of temperatures, ventilation and damage.

B2 Quality requirements for marketing root crops and field vegetables

- Market specifications, including size, shape, quality requirements, tenderness and texture.
- Contractual specifications:
  - supermarket, including impact on saleability, e.g. skin finish, blemishes, size and shape
  - processor, including impact on ability to use in processing, moisture content, human consumption end use, e.g. ready meals, dried food products
  - manufacturer, including impact on end use, e.g. roast, chipping, mashing, animal feed
  - seed, including impact on suitability for use, including variety, being free from disease, variety and germination test results
  - food standards and traceability, including the importance of being able to track the process from field to fork
  - quality assurance schemes, including grower confirmation that commodities have been produced according to required standards and are fit for sale at that point.
- Grading, including removing debris, foreign objects, soil, small immature crop samples.
- Using automatic grading machines.
- Sorting, including selecting for size and market.
- Using auto-selecting machinery for sorting.
- Transporting root crops and field vegetables from field to farm, farm to store, store to sale.
- Production targets:
  - inputs, including cost of seed, fertiliser, chemicals, levies and charges
  - outputs, including price per tonne, premiums, bonuses and deductions
  - gross margins.
- Biosecurity, including grower responsibility for appropriate waste disposal methods, e.g. for feed, small immature crop samples, plastic and bags.

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Learning aim C: Carry out husbandry tasks related to root crops and field vegetables

C1 General husbandry tasks

- Importance of timing, schedules and time management in carrying out husbandry activities.
- Soil and seedbed preparation and cultivation techniques.
- Date of drilling or planting and its effect on growth, yield and quality.
- Crop protection methods against extreme weather, e.g. flooding, high winds, extreme heat, extreme cold, drought.
- Irrigation requirements, including timing, amount of irrigation needed by the crop, sources of irrigation supply, e.g. lagoon, borehole.
- Monitoring growth and development of root crops and field vegetables.
- Harvesting operations.
- Appropriate disposal of waste, e.g. seed, bags, chemicals.
- Consideration of biosecurity and sustainable waste disposal practices.

C2 Fertiliser application

- Sources of fertiliser available, including organic and inorganic types.
- Timing of fertiliser application.
- Importance of understanding root crop growth stages in relation to fertiliser application.
- Importance of understanding field vegetable growth stages in relation to fertiliser application.
- Importance of applying correct amount of fertiliser and the consequences of not applying correct amount.
- Methods of calculating fertiliser rates, yield mapping, N-Sensor data, variable rate application, Global Positioning System (GPS) mapping, computer programs, e.g. PLANET.
- Application methods, e.g. manure spreader, fertiliser spreader, liquid sprayer.
- Examples of solid fertiliser, including farmyard manure, granular fertiliser.
- Examples of liquid fertilisers, including:
  - straight liquid, e.g. nitrogen only
  - blended fertiliser, e.g. nitrogen and other suspensions.

C3 Weed, pest and disease control

- Identifying common weeds, pests and diseases of root crops.
- Recommending control measures to address weeds, pests and diseases.
- Advantages and disadvantages of control measures to address weeds, pests and disease.
- Specific health and safety measures associated with weed, pest and disease control, including:
  - local environmental risk assessment for pesticides
  - other aspects of risk assessments, e.g. use of personal protective equipment (PPE).
- Interpreting agronomist recommendations.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate production and husbandry requirements for root crops and field vegetables		
A.P1 Explain the influence of biological and physical factors on the production of root crops and field vegetables. **A.P2** Explain the key husbandry requirements for the production of root crops and field vegetables, including legal requirements.	**A.M1** Assess the influence of biological and physical factors on the production of root crops and field vegetables. **A.M2** Assess the key requirements for the production of root crops and field vegetables, including the role of legal requirements.	**A.D1** Evaluate the importance of biological and physical factors, husbandry and legal requirements for root crops and field vegetable production.
Learning aim B: Explore the processing and quality requirements for marketing root crops and field vegetables		
B.P3 Explain the key aspects in processing root crops and field vegetables to meet quality requirements. **B.P4** Explain the key marketing requirements of root crops and field vegetables, including production targets.	**B.M3** Assess the importance of quality requirements and production targets in processing and marketing root crops and field vegetables.	**B.D2** Evaluate the impact of quality requirements and production targets on the processing and marketing of root crops and field vegetables.
Learning aim C: Carry out husbandry tasks related to root crops and field vegetables		**C.D3** Carry out husbandry tasks with a high degree of accuracy to promote growth and development of root crops and field vegetables, including nutrient application and crop protection tasks.
C.P5 Competently carry out husbandry tasks to promote growth and development of root crops and field vegetables. **C.P6** Competently carry out nutrient application and crop protection methods to meet given objectives for root crops and field vegetables.	**C.M4** Efficiently carry out husbandry tasks to promote growth and development of root crops and field vegetables. **C.M5** Efficiently carry out nutrient application and crop protection methods on root crops and field vegetables to meet given objectives.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M3, C.M4, C.M5, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of commercial root crops and field vegetables for regular inspection
- field records for root crops and field vegetables to determine input and outputs
- agronomy data for root crops and field vegetables.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will produce an in-depth investigation of the production requirements for one root crop and one field vegetable crop. They will make consistently valid, accurate connections between the key biological and physical requirements for root crops and field vegetable production, including the climate and soil preferences dictated by the crop. Learners will show insight in all aspects of production needs, which will include comprehensive understanding of the husbandry requirements in preparing for the establishment of the crop. They will also make specific, valid connections relating to the impact of legislation on root crop and field vegetable production. Learners' evidence will demonstrate breadth and depth of understanding in all areas, using specific agricultural terminology accurately and consistently throughout.

For Merit standard, learners will make appropriate, clear judgements on the production requirements for one root crop and one field vegetable. They will make mainly relevant connections between the key biological and physical requirements for root crops and field vegetables, including mostly valid detail on the requirements of the climate and soil preferred by the crop. Learners will make clear, mostly logical justifications of the husbandry requirements in preparing for the establishment of the crops. They will demonstrate a breadth of understanding regarding the impact of legislation on root crop and field vegetable production. Learners' evidence will be technically correct and show use of correct agricultural terminology.

For Pass standard, learners will provide a limited but realistic account of the production requirements of one root crop and one field vegetable. They will make some basic connections between the key biological and physical needs of the crops, demonstrating a basic understanding of the effects of climate and soil type on crop production. Learners will show a realistic awareness of the establishment needs of the crop, but the evidence may be limited in scope. They will provide a limited account of the impact of legislation on root crop and field vegetable production and may not provide examples or reasons for their views. Learners' evidence will show some use of agricultural terminology, though this may be limited and inaccurate in parts.

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Learning aims B and C

In order to achieve learning aims B and C, learners are required to carry out husbandry tasks to demonstrate the practical skills of husbandry. Teachers should ensure that crops chosen by learners provide sufficient scope for them to fully complete the assessments.

For Distinction standard, learners will give an in-depth evaluation of the processing of one root crop and one field vegetable. They will consider thoroughly all the relevant stages, from when the crops are marketed on the farm and through the relevant processing plant. Learners' evidence will be comprehensive and will include an accurate breakdown of the processing of root crops and field vegetables. They will include information on the harvesting, storing and processing of crops and make consistently valid, logical links between crop quality requirements and how these affect the end use of the product. Learners will give in-depth consideration to the importance of marketing, including insightful, accurate references to the role of specifications, finances and production targets. They will demonstrate the practical skills required to carry out husbandry tasks for root crops and field vegetables with a high degree of accuracy. Learners will carry out the tasks confidently, and show initiative in doing so, within the limits of their responsibility.

Learners will fully complete the required tasks. In doing so, they will comply at all times with health and safety requirements, assessing risks and minimising injury to self and others, selecting and using all equipment appropriately and with a high degree of accuracy, and reflecting best practice in the industry.

Learners will complete detailed and accurate records as appropriate to the work undertaken. They will demonstrate detailed knowledge of fertiliser application as well as weed, pest and disease identification and control, making consistently logical judgements that show they understand the importance of these husbandry tasks in relation to overall crop health. Learners' evidence will use specific agricultural terminology and will be accurate throughout.

For Merit standard, learners will provide clear, mostly relevant judgements on the processing of one root crop and one field vegetable, from when the crops are marketed on the farm and through the relevant processing plant. They will show breadth and some depth of understanding, providing clear understanding of the harvesting, storing and processing of crops. They will make mostly valid justifications between crop quality requirements and how these affect the end use of the product. Learners will give a clear, detailed assessment of the role of marketing, including mostly relevant references to the role of specifications, finances and production targets.

Learners will efficiently carry out practical husbandry tasks for root crops and field vegetables, showing some initiative within the limits of their responsibility. They will complete these tasks appropriately, complying with health and safety requirements and assessing the risks. Learners will keep records, as appropriate to the tasks and with sufficient detail, so it is clear what has been carried out. They will demonstrate a clear understanding of fertiliser application as well as weed, pest and disease identification. Learners will make mostly logical judgements that show they understand the importance of these husbandry tasks in relation to overall crop health. Learners' evidence will show mostly accurate use of specific agricultural terminology.

For Pass standard, learners will give a limited report on the processing of one root crop and one field vegetable, from when the crops are marketed on the farm and through the relevant processing plant. They will provide basic detail on crop harvesting, storing and processing of crops, highlighting the most obvious aspects of production and associated requirements. Learners will make basic, realistic links between crop quality requirements and how these affect the end use of the product but the evidence will be unsupported or superficial in parts. They will give a realistic, basic explanation of marketing, including some appropriate but undeveloped references to the role of specifications, finances and production targets.

Learners will carry out practical husbandry tasks for root crops and field vegetables with competence, completing them appropriately but showing little initiative within the limits of their responsibility. Learners will complete the required tasks safely and adhere to health and safety requirements but will show limited knowledge of associated risks and their controls. They will show an awareness of the need to keep appropriate records that provide the key information. Learners will show some breadth of understanding of fertiliser application as well as weed, pest and disease identification. They will make decisions that show a realistic but undeveloped understanding of the importance of these husbandry tasks in relation to overall crop health. Learners' evidence will show some use of agricultural terminology though there may be omissions.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 17: Crop Production
- Unit 18: Crop Handling, Storage and Quality Assurance.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research and presentation skills
- analysis skills when processing and marketing produce
- independent working practices when working outdoors.

Unit 22: Organic Agricultural Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop an understanding of organic agriculture for livestock and crops, and skills in the management of biological and ecological cycles on organic farms.

Unit introduction

Organic farming is an alternative agricultural system that originated early in the 20th century and continues to be developed by various organisations today. This growing industry is heavily regulated and encompasses much more than the use of organic fertilisers such as compost, manure, green manure and bone meal. It also places emphasis on techniques such as crop rotation, companion planting and sustainable grazing of livestock.

In this unit, you will examine the values and principles that form the basis of organic farming. You will investigate the practices that farmers adopt to adhere to an organic agricultural system. The term 'organic' is used generically in the context of this unit, so that complementary philosophies such as biodynamic agriculture can be considered. Throughout the unit, you will have opportunities to experience organic farm enterprises practically, as you observe and reflect on how organic farming methods affect the health of the soil, crops, animals and the environment, and how they differ from non-organic farming practices and management.

On completion of this unit, you will be able to apply the values, principles and methods of organic production within an organic farm enterprise. This unit will help you progress to working on an organic farm as a farm hand or technician, or to progress to higher education having developed a sound understanding of organic agriculture.

Learning aims

In this unit you will:

A Investigate the core principles of organic agricultural production and its ecological impact

B Explore organic crop production methods in order to plan crop rotation

C Explore organic livestock production methods in order to plan livestock management.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the core principles of organic agricultural production and its ecological impact	**A1** Organic principles **A2** Soil processes **A3** Soil fertility **A4** Sustainable agro-ecosystems in an organic environment	A report or presentation evaluating the principles of organic production and the impact that soil processes and fertility can have on agro-ecosystems.
B Explore organic crop production methods in order to plan crop rotation	**B1** Soil management **B2** Crop rotation **B3** Potential problems with crop systems	A three-year crop rotational plan for two crop species and an animal management plan for one species of livestock.
C Explore organic livestock production methods in order to plan livestock management	**C1** Key principles of livestock management **C2** Potential challenges in livestock management **C3** Organic feeding	

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Content

Learning aim A: Investigate the core principles of organic agricultural production and its ecological impact

A1 Organic principles

Origins of the organic movement and the increasing popularity of the consumption and use of organic foods.

- The organic farming movement, including:
  - historical background of food production before the Industrial Revolution
  - farming after the Industrial Revolution, e.g. Enclosure Acts, intensive methods, chemicals, industrial farming, increase in population
  - key influencers, including Stapledon, Steiner, Rusch, Lady Balfour and Sykes
  - sustainability, e.g. UN Declaration 1987
  - development of organic standards
  - permaculture
  - conversion.
- Regulations associated with key organic organisations:
  - membership or subscriptions to organic certification bodies and associated costs
  - codes of practice and industry schemes
  - labelling schemes, including the Organic Milk Suppliers Cooperative (OMSCo) and the Soil Association
  - current legislative and industry requirements at time of teaching.
- Principles of organic agriculture, including the use of IFOAM – International Federation of Organic Agriculture Movements – principles to identify organic agriculture:
  - the principle of health
  - the principle of ecology
  - the principle of fairness
  - the principle of care.
- Traceability of organic products, including separation, documentation, labelling and inspection processes.

A2 Soil processes

- Soil properties and types.
- Soil structure.
- Testing and assessment of soils.
- Micro-organisms, including bacteria and fungi.
- Macro-organisms, including earthworms and nematodes.
- Chemical properties, including pH, cations, anions and exchange capacity.
- Soil erosion.
- Biological properties, including nitrogen cycle, carbon cycle, biological nitrogen fixation and mycorrhiza.
- Organic matter and humus.

A3 Soil fertility

- Natural fertility, e.g. essential elements, plant nutrients.
- Manures, e.g. green manure, animal manure, breakdown in soil.
- Leaching.
- Compost.
- Crop rotations.
- Current environmental legislation, including closed seasons for spreading organic manures.
- Current restrictions regarding the use of external inputs, including low-solubility mineral fertilisers.

A4 Sustainable agro-ecosystems in an organic environment

- Living and non-living components and their interactions.
- Threats to sustainable food production and ecosystem functioning caused by human impacts on soils and ecosystems.
- Anthropogenic activities, including reducing the environmental impacts of agriculture.
- Similarities and differences between global organic agro-systems and local organic systems.
- Effectiveness of organic systems compared to intensive systems, including advantages and disadvantages.

Learning aim B: Explore organic crop production methods in order to plan crop rotation

B1 Soil management

Soil management as a fundamental requirement for healthy agro-systems.

- Conversion process, including fertiliser and pesticide residues.
- Soil degradation.
- Cultivation systems, including timing of crop planting.
- Fallow management.
- Stockless systems.
- Impact of poor soil management.
- Potential problems, including nitrate leaching following ploughing of legume-rich grassland.

B2 Crop rotation

The impact of crop rotation on soil and crop health and management.

- Reasons for crop rotation.
- Role of livestock and manures in crop rotation.
- Importance of choice and diversity, including grasses, arable and permanent crops such as fruit.
- Quality requirements, including the achievement of industry standards to allow crops to be certified as organic.

B3 Potential problems with crop systems

- Weed control methods, including mechanical cultivation, timing, shading, crop competition, mulching and hand weeding.
- Potential weed control problems, including incomplete control and disturbing ground-nesting birds.
- Key aspects of pest and disease control, including cultivar resistance and tolerance, biological control, natural predators, beetle banks and permitted pesticides (including fatty acids and 'basic substances').
- Dealing effectively with potential pest and disease control problems, including appropriate use of biological control agents and the breakdown of single-gene cultivar resistance.
- Crop nutrition in organic systems.

Learning aim C: Explore organic livestock production methods in order to plan livestock management

C1 Key principles of livestock management

Meeting the needs of different livestock and managing livestock impact on the environment.

- Choice of livestock, including dairy and beef cattle, sheep and poultry.
- Breed selection and its impact on the environment.
- Welfare and current legislation and codes of practice.
- Grazing systems.
- Stocking rates.
- Use of legumes.

C2 Potential challenges in livestock management

- Demands of markets and outlets, including quality requirements and industry standards.
- Breeding, including closed systems, mating and weaning.
- Zoonoses.
- Biosecurity, including regulations and approved disinfectants for dairy system cleaning and other on-farm uses.
- Preventive management.
- Role of veterinary medicine and restrictions of use in organic farming.
- Grazing management for parasite control.
- Health care plans.
- Advantages and disadvantages of complementary therapies for animals.
- Impact of organic production on animal welfare.

C3 Organic feeding

Regulations and practices for feeding organic livestock.

- Nutrition and feeds.
- Permitted crops for grazing and feeding.
- By-products.
- Use of home-grown feeds.
- Current permitted inclusion rates for non-organic feedstuffs.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate the core principles of organic agricultural production and its ecological impact		**A.D1** Evaluate the principles of organic production and the impact that soil processes and fertility can have on agro-ecosystems.
A.P1 Explain the principles of organic production. **A.P2** Explain the ecological impact of organic agricultural production.	**A.M1** Analyse the principles of organic production and the potential impact of soil processes and fertility on agro-ecosystems.	
Learning aim B: Explore organic crop production methods in order to plan crop rotation		**B.D2** Produce a comprehensive crop rotation plan in an organic system for named crops, evaluating the impact of fundamental soil management principles.
B.P3 Explain the fundamental principles of soil management in organic crop production. **B.P4** Produce a basic crop rotation plan in an organic system for named crops.	**B.M2** Analyse the importance of fundamental soil management principles in organic crop production. **B.M3** Produce a detailed crop rotation plan in an organic system for named crops.	
Learning aim C: Explore organic livestock production methods in order to plan livestock management		**C.D3** Produce a comprehensive animal management plan for livestock species in an organic system, evaluating the role of livestock management.
C.P5 Explain livestock management in an organic system for livestock species. **C.P6** Produce a basic animal management plan for a livestock species in an organic system.	**C.M4** Analyse livestock management in an organic system for livestock species. **C.M5** Produce a detailed animal management plan for livestock species in an organic system.	

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The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, B.M3, C.M4, C.M5, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to an organic farm.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will show a robust understanding of the background to organic agriculture and its core principles, making insightful references to key influencers and the IFOAM principles to define the operational nature of organic farms. They will show comprehensive knowledge of organic farming regulatory requirements, with a completely holistic approach, covering crops and livestock. There will be in-depth understanding of the complexities of conversion to organic farming and the organisation and maintenance of organic farms. They will demonstrate an in-depth understanding of soil processes, soil types and properties, testing techniques and chemical properties. They will make consistently relevant, specific links to soil and key biological processes, including nitrogen and carbon cycles, linking them, in turn, to soil health and organic farming success. Learners will give detailed consideration to how soil fertility is vital for farming success, drawing on breadth and depth of knowledge to evaluate appropriate methods of maintaining and improving soil fertility in an organic system. They will make accurate references to the impact of current environmental legislation, restrictions and requirements for organic farmers.

Learners will give well-reasoned arguments, including the advantages and disadvantages of organic farming as they synthesise in-depth knowledge and understanding of organisations and legal implications. They will make direct links to organic practices and ecosystem health by evaluating existing agro-ecosystems and anthropogenic activities, with advantages and disadvantages robustly explored. The evidence will use agricultural terminology appropriately and consistently.

For Merit standard, learners will show a clear understanding of the background to organic agriculture and its core principles, making mostly relevant references to key influencers and the IFOAM principles to define the operational nature of organic farms. They will present depth but limited breadth of understanding of the regulatory requirements of organic farms with a holistic approach, covering crops and livestock. There will be clear understanding of the complexities of conversion to organic farming and the organisation and maintenance of organic farms. Learners will show a detailed understanding of soil processes, soil types and properties, testing techniques and chemical properties. They will make limited connections to soil and key biological processes, including nitrogen and carbon cycles. Learners will make mostly relevant connections between soil health and organic farming success. They will provide detail but will lack depth in their understanding of how soil fertility is vital for farming success, explaining appropriate methods of maintaining and improving soil fertility in an organic system. They will show a clear understanding of the role of current environmental legislation, restrictions and requirements for organic farmers.

Learners will give mostly relevant reasons for their arguments, including the advantages and disadvantages of organic farming, where they will make appropriate references to organisations and legal implications. Learners will make links to organic practices and ecosystem health by analysing existing agro-ecosystems and anthropogenic activities, and will explore advantages and disadvantages with some depth of understanding. Learners will use agricultural terminology appropriately in their analysis.

For Pass standard, learners will show a basic understanding of the background to organic agriculture and its core principles. They will make general or superficial references to key influencers and the IFOAM principles to define the operational nature of organic farms. Learners will present limited depth and breadth in their understanding of regulatory requirements of organic farms but will adopt a holistic approach, covering crops and livestock with some inaccuracies. They will show narrow or generalised understanding of the complexities of conversion to organic farming and the organisation and maintenance of organic farms. Learners will have a realistic but undeveloped understanding of soil processes, soil types and properties, testing techniques and chemical properties. They will make some valid, limited connections to soil and key biological processes, including nitrogen and carbon cycles. They will demonstrate a realistic but undeveloped understanding of the relationship between soil health and fertility and organic farming success. They will explain some appropriate methods of maintaining and improving soil fertility in an organic system.

Learners will demonstrate undeveloped but realistic references to current environmental legislation, restrictions and requirements for organic farmers. There will be some relevant understanding of simple advantages and disadvantages of organic farming, making basic references to organisations and legal implications, with some inaccuracies. They will make some valid links to organic practices and ecosystem health by explaining existing agro-ecosystems and anthropogenic activities. The evidence will make some use of agricultural terminology.

Learning aims B and C

For Distinction standard, learners will produce a convincing, comprehensive organic crop rotation plan over a three-year period for two suitable crop species and a convincing, comprehensive livestock management plan for one suitable species. The plans will be robust and show an in-depth understanding of organic crop and livestock management, giving accurate, well-developed reasons for having an integral approach. They will make well-reasoned references to soil management as a key requirement for healthy agro-systems. Learners will evaluate thoroughly the impact of soil management methods on overall crop and livestock success and farm ecosystem health. They will have a well-developed understanding of soil management strategies, cultivation systems, fallow management, reasons for crop rotation, choice of crops, role of livestock and manures. They will show insight in highlighting potential problems in an organic system for both crops and livestock, offering breadth and depth in their understanding of such problems and in strategies that could be used to overcome them. The evidence will present a holistic approach, having logical plans supported by robust, balanced justifications for choices made, including insightful discussion of advantages and disadvantages. Learners will be consistent and accurate in their use of agricultural terminology.

For Merit standard, learners will produce a clear, detailed organic crop rotation plan over a three-year period for two suitable crop species and a clear, detailed livestock management plan for one suitable species. The plans will contain all key information and show detailed understanding of organic crop and livestock management, giving clear but partially developed reasons for having an integral approach. They will make mostly accurate references to soil management as a key requirement for healthy agro-systems. Learners will give a balanced analysis of the impact of soil management methods on overall crop and livestock success and farm ecosystem health. They will show detailed understanding of soil management strategies, cultivation systems, fallow management, reasons for crop rotation, choice of crops, role of livestock and manures.

They will give appropriate details of potential problems in an organic system for both crops and livestock, with relevant understanding of such problems. They will show mostly relevant understanding of the appropriate strategies that could be used to overcome these problems. The evidence will present a mainly integrated approach, having a partially developed plan supported by mainly valid reasons for choices made. Learners will explore the advantages and disadvantages of their choices within the plans. Learners will be mostly accurate in their use of agricultural terminology.

For Pass standard, learners will choose two suitable crop species for the crop rotation plan and one livestock species for the livestock management plan. The plans will be undeveloped but realistic, showing limited breadth and depth of understanding of the principles of organic crop management, livestock management and soil management. They will present undeveloped reasons for having an integral approach. Learners will give a limited, realistic explanation of the impact of soil management methods on crop and livestock success and overall farm ecosystem health. They will demonstrate basic understanding of soil management strategies, cultivation systems, fallow management, reasons for crop rotation, choice of crops, role of livestock and manures. The evidence will show an undeveloped or unbalanced approach in highlighting the potential problems in an organic system for both crops and livestock. Learners will give a limited discussion of how to overcome these problems, with some relevant examples used to support their ideas. Advantages and disadvantages of their choices will be superficially defined and may contain some irrelevancies. Learners will use some accurate agricultural terminology.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 10: Farm Livestock Husbandry
- Unit 17: Crop Production
- Unit 18: Crop Handling, Storage and Quality Assurance.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit

- research skills
- presentation and interpersonal skills when working with others
- analytical and evaluative practices when investigating plant and animal organic production
- mathematical skills and knowledge when creating a crop rotation plan.

Unit 23: Land-based Machinery Operations

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop skills in the safe operation of machines used in the land-based sectors, including carrying out pre-start checks, basic maintenance and repair, and actual operation.

Unit introduction

Machines are used throughout the land-based sectors for a range of purposes, including transport and powering or pulling other equipment. The correct selection, maintenance and use of machinery are extremely important to the success of all enterprises and sustainable working practices.

In this unit, you will explore machines relevant to your particular sector of the industry, developing practical skills and understanding of the different conditions in which machinery might need to operate. You will learn how to carry out pre-start checks and maintenance on these machines as well as the safe use and operation of the machine for a variety of tasks. The skills and knowledge gained in this unit will help you to manage the potential dangers involved in operating land-based machinery, and enable you to carry out tasks in a way that prioritises safety and consideration of environmental impact.

This unit will support your progression to employment in the land-based sectors in a role such as machinery operations assistant and assistant technician, or to further study in an apprenticeship or higher education.

Learning aims

In this unit you will:

A Investigate the types, purpose and safe operation of land-based machinery

B Operate land-based machinery safely to complete a practical task

C Maintain land-based machinery safely in order to sustain its effectiveness.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the types, purpose and safe operation of land-based machinery	**A1** Types of machine and their purpose **A2** Principles of operation **A3** Range of conditions in which machinery may be operated **A4** Health and safety considerations	A report examining machinery types, their uses and operation for a relevant sector of the land-based industries.
B Operate land-based machinery safely to complete a practical task	**B1** Preparation **B2** Operation	Evidence of safe completion of practical tasks that include the preparation and operation of a suitable machine to achieve the task being carried out.
C Maintain land-based machinery safely in order to sustain its effectiveness	**C1** Maintenance **C2** Servicing and repair	Evidence of a machine being checked before and after use, and maintenance requirements being identified. A report evaluating the effectiveness of the preparation, routine maintenance and repair carried out, and the options available to do this.

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Content

Learning aim A: Investigate the types, purpose and safe operation of land-based machinery

A1 Types of machine and their purpose

The types of machine available and the purposes for which they are used in the land-based sector.

- Types of machine:
  - tractors, including two- and four-wheel-drive systems, track-layers
  - utility vehicles
  - all-terrain vehicles (ATVs)
  - special purpose vehicles, e.g. self-propelled harvesters or mowers, material handlers
  - pedestrian-operated and hand-held machines.
- Adaptations for different purposes, including working on slopes, inside buildings and on soft or unfirm ground.
- Purposes of machines:
  - transport of goods and people
  - estate maintenance, e.g. brush cutters, hedge cutters, flails
  - pulling other equipment, e.g. trailers, mowers
  - powering attached equipment via external services, e.g. powered cultivators, mowers
  - excavation, e.g. trenching, ditching, landscaping
  - application of materials, e.g. seed, organic material, fertiliser and plant protection products.

A2 Principles of operation

- Available power sources:
  - engines, to include spark ignition, two- and four-stroke cycle, compression ignition, four-stroke and electric motors
  - fuels, to include petrol, diesel, liquid petroleum gas (LPG), biofuels and electricity, including single phase, three phase and battery
  - potential environmental impact of different engine types.
- Drive systems:
  - belts, chains and gearboxes:
    - their characteristics and use
    - advantages and disadvantages
  - hydrostatic systems:
    - their characteristics and use
    - advantages and disadvantages
  - two- and four-wheel-drive systems
  - different and equal-size wheels.
- Machine layout, design and safety features:
  - location of controls for powered machines, e.g. on/off switches, brakes, clutch, throttle/accelerator, gear lever, lights and indicators, operating sequences, emergency stop mechanisms
  - access, including doors, steps, protective covers and guards
  - aspects of sustainability relevant to machine design and layout, e.g. fuel type, fuel efficiency, emissions, noise pollution, and lubrication.

- Ancillary equipment:
  - hitches to attach trailed equipment, e.g. pick-up hitches, clevis drawbars
  - three-point linkage to attach mounted or semi-mounted equipment, e.g. ploughs, mowers and cultivators
  - external services, e.g. electrical, power take-off (PTO), shafts, hydraulics.
- Machine safety features and procedures:
  - safe operating procedures, e.g. starting the machine when it is out of gear, starting the machine with the operator in the driving position
  - safety features to prevent starting of the machine, e.g. out of gear, being on seat, depressed clutch
  - engine stop, e.g. key and fuel cut off
  - access, to include steps and guards
  - other safety features, e.g. anti-reverse for working pedestrian rotary tillers, safety cabs or frames, seat belts.

A3 Range of conditions in which machinery may be operated

- In the field or on site:
  - slopes
  - size of field/working area and topography
  - soil types and ground conditions
  - access.
- Weather and seasonality:
  - drought, wet, rain, snow, normal conditions
  - tasks in relation to time of year and seasons.

A4 Health and safety considerations

Health and safety aspects relevant to the use of machinery in land-based sectors.

- Legislation/national laws relevant to the use of land-based machinery:
  - regulations regarding the permission and competence required to carry out certain land-based operations, such as:
    - minimum driver age limits
    - regulations for safe lifting operations and lifting equipment and regulations for the provision and use of work equipment
    - 'on the road' use of machinery
    - certificates of competence, e.g. spraying, material handling.
- Self-protection and protection of others:
  - legislation/law for health and safety at work
  - personal protective equipment, e.g. safety boots, goggles, overalls, gloves
  - safe systems of work, use of manuals, safe use of controls and cut-outs
  - risk assessments
  - manual handling techniques.
- Potential consequences of not complying with health and safety requirements, such as:
  - injury to self and others
  - prosecution
  - invalidating insurance
  - ineffective and inefficient machines.

Learning aim B: Operate land-based machinery safely to complete a practical task

B1 Preparation

Preparing and checking machines before use and operation.

- Daily checks, adjustment, attachments, lubrication.
- Resources, to include consumables:
  - lubricants
  - cleaning agents, rags and towels
  - variety of tools
  - benches or workshop area.
- Use of PPE.
- Setting up of machine, e.g. position, mixed or draft control, guarding, setting maximum height or depth, working height or depth.

B2 Operation

Operation of relevant machinery in a field or site location.

- Pre-start checks, to include oil, fuel, water, ancillary fittings, tyres, visual checks, lights – where applicable.
- Attachment of equipment, e.g. trailer, link box, mower, spreader or cultivation equipment.
- In-field use, to include starting and stopping, work method, control of attached equipment, forward speed.
- Safe working procedures, e.g. knowledge of operator manual, safe mounting of and dismounting from machine, stopping machine to carry out adjustments and in-field maintenance.
- Aspects of sustainability relevant to machinery operation, e.g. use of energy-saving mode, correct gear and engine speed selection.

Learning aim C: Maintain land-based machinery safely in order to sustain its effectiveness

C1 Maintenance

Carrying out routine operator maintenance.

- Use of operator manuals.
- Understanding service intervals.
- Adjustments of drive devices, e.g. tension chains or belts.
- Checking of tyre pressures.
- Checking of liquids, e.g. fuel, coolant and oil levels, battery electrolyte level.
- Checking of guards for overall fitness for purpose and security of fittings.
- Checking of air filters.

C2 Servicing and repair

- Available options for carrying out servicing and repairs:
  - dealership services
  - in-house servicing and repairs by own mechanic
  - repairs in non-dealership workshop.

- Advantages and disadvantages of the different options for carrying out servicing and repairs, e.g. availability, time, warranty and cost.
- Understanding warranties, their advantages and disadvantages.
- Cost-effectiveness of servicing and repair, routine maintenance and maintenance intervals.
- Identifying faults and problems that require servicing and repair:
  - wear and tear, e.g. worn transmission and steering components, tyres, cutting blades, tines, knives, spark plugs, injectors, blocked filters
  - use of manufacturer part numbers and machine identification
  - health and safety issues, including loose, worn and missing guards.
- Carrying out simple servicing and repair:
  - use of operator's manual
  - renew oils
  - clean or renew filters
  - adjustments, e.g. tensions, pressures
  - maintain and update records of work
  - relevant repairs, e.g. replacement of belts, tines, blades, battery replacement, spark plug or injector replacement, guard replacement
  - recycling or disposing of waste materials and parts in line with accepted practice, e.g. recycling of waste oil, recycling of tyres, use of exchange parts and return.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate the types, purpose and safe operation of land-based machinery		
A.P1 Explain the purpose and operation of different types of land-based machine. **A.P2** Explain the health and safety requirements in the operation of land-based machinery.	**A.M1** Compare the principles of operation of different types of selected land-based machine. **A.M2** Analyse the importance of health and safety requirements in the operation of land-based machinery.	**A.D1** Justify the selection of different types of land-based machinery for a given land-based task.
Learning aim B: Operate land-based machinery safely to complete a practical task		
B.P3 Safely prepare selected land-based machinery for work. **B.P4** Safely operate simple land-based machinery to meet given objectives.	**B.M3** Efficiently use complex land-based machinery to meet given objectives.	**B.D2** Evaluate own operation of land-based machinery against given objectives.
Learning aim C: Maintain land-based machinery safely in order to sustain its effectiveness		
C.P5 Explain the options available for the servicing and repair of land-based machinery. **C.P6** Safely carry out routine operator maintenance and appropriate repairs for a chosen land-based machine.	**C.M4** Assess potential faults on a given land-based machine, using manufacturer's data to specify replacement items during servicing and repair. **C.M5** Carry out efficient routine operator maintenance and appropriate repairs for a chosen land-based machine.	**C.D3** Evaluate the effectiveness of techniques used to carry out routine maintenance and repair, and the options available to do this.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of three summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aim: B (B.P3, B.P4, B.M3, B.D2)

Learning aim: C (C.P5, C.P6, C.M4, C.M5, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of common and specialist hand tools, including power tools and testing equipment
- suitable PPE
- a range of prime movers, including tractors and ride-on mowers and transporters
- a range of compatible attachments, including trailers and three-point linkage mounted equipment
- a flat, level site on which to operate
- basic workshop facilities, including vices, benches, fuels and lubricants.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will thoroughly investigate the machines available to a relevant sector of the land-based industry and fully justify the selection of two different types of machine for given tasks in a way that is logical, coherent and considers all relevant factors. The task will require the selection of some form of ride-on prime mover such as a tractor, haulage/transport vehicle or ride-on machine such as a mower. Evidence will display the accurate use of relevant terminology throughout to support a considered, well-reasoned response. Learners will make insightful references to the role of health and safety in the selection of different types of machine. Learners will meticulously investigate the problems associated with different conditions of use, produce robust, convincing solutions to these problems and make comprehensive, accurate references to relevant aspects of health and safety and sustainability.

For Merit standard, learners will provide a clear, balanced review of the principles of operation of land-based machines and report on the principles of operation of two different machines for given tasks in the land-based sector. The task will require the selection of some form of ride-on prime mover such as a tractor, haulage/transport vehicle or ride-on machine such as a mower. The evidence provided will be technically accurate and compare clearly the principles of operation of the two machines. The solutions given by learners will be efficient and suitable. Clear and relevant consideration will be given to aspects of health and safety and sustainability. Learners' evidence will show relevant and accurate analysis of each machine and make use of appropriate technical language. Learners will explore the problems caused by different conditions and provide relevant justifications of their design solutions. Learners will provide a balanced, clear analysis of the importance of health and safety requirements in machine operation.

For Pass standard, learners will examine the machines available to the land-based sectors and explain the selection of two different machines for given tasks. The task will require the selection of some form of ride-on prime mover such as a tractor, haulage/transport vehicle or ride-on machine such as a mower. Most of the evidence will be technically accurate and relevant. Learners will report on the suitability of the machines for a range of conditions. Their response might be limited in scope or unbalanced in parts but will be mostly appropriate, including realistic, specific references to health and safety, and limited but appropriate references to sustainability.

Learning aim B

For Distinction standard, learners will evaluate the qualitative standard of practical work undertaken to achieve the completion of tasks against the given objectives, which include meeting relevant health and safety requirements. Learners will support their views with well-reasoned, convincing judgements. Learners will provide specific, well-selected evidence to show how and why their work meets the given requirements, making logical, robust connections between their performance and the given brief.

Learners will demonstrate use of complex machinery, requiring multiple operations and use of appropriate equipment. The evidence will include the use of power take-off (PTO)-powered three-point linkage mounted equipment. Tasks will be undertaken efficiently, accurately and completely, meeting the specification requirements. Learners will work safely to a professional industry standard and they will comply with best workplace practice at all times.

For Merit standard, learners will safely carry out tasks involving complex machinery that requires multiple operations, using appropriate equipment and a variety of tools and materials. Learners will demonstrate the use of PTO-powered three-point linkage mounted equipment. Learners will show clear evidence of both preparing and operating complex land-based machinery to meet given objectives. Tasks will be undertaken efficiently, accurately and completely, meeting the specification requirements. Learners will work to the standard of a competent employee.

Learners will demonstrate best workplace practice by working safely and in accordance with relevant legislation, ensuring the workplace is prepared and cleared. They will understand the need for, and demonstrate, correct tool, material and equipment procedures, including selection, use, transport, maintenance and storage.

For Pass standard, learners will undertake tasks competently, safely and completely, meeting the specification requirements. Learners will safely prepare and operate simple land-based machines such as ride-on mowers and tractors for haulage. They will work to the standard of a novice employee.

Learners will demonstrate acceptable workplace practice by working safely and in accordance with relevant legislation, ensuring the workplace is cleared after task completion. They will demonstrate mostly correct tool, material and equipment procedures, including selection, use, transport, maintenance and storage.

Learners will show a realistic understanding of how different operator techniques may be used, although some aspects of their understanding might be limited in scope.

Learning aim C

For Distinction standard, learners will review thoroughly the effectiveness of the techniques and workshop practices used to undertake the completion of tasks, supporting their views with well-reasoned judgements that cover all relevant factors. Learners will evaluate and report on how the techniques and practices used resulted in routine operator maintenance and repair being undertaken efficiently, accurately and completely. Learners will similarly provide an in-depth evaluation of the options available to carry out routine operator maintenance and repair, providing specific reasons that link logically to their views. Learners will dispose of any waste materials in a manner that fully complies with accepted practices and which shows full regard for the concepts and practices of sustainability. Evidence will use relevant and accurate terminology throughout, which supports a considered, comprehensive response.

For Merit standard, learners will undertake tasks efficiently, accurately and completely, meeting the specification. Learners will proficiently, without errors, carry out routine maintenance and repair tasks, using appropriate equipment and a variety of tools and materials. They will work to the standard of a competent employee.

Learners will demonstrate best workplace practice by working safely and in accordance with relevant legislation, ensuring that the workplace is prepared and cleared. They will understand the need for, and demonstrate, correct tool, material and equipment procedures, including selection, use, transport, maintenance and storage. Learners will dispose of any waste materials in a manner that fully complies with accepted practices.

Learners will demonstrate clear understanding of the options for repair and maintenance by correctly assessing and reporting on potential faults in a machine and using the manufacturer's data to correctly specify replacement parts. Learners' assessment will be clear and technically accurate. They will use appropriate technical language in their evidence but this may be inconsistent.

For Pass standard, learners will demonstrate that they can work safely and completely, meeting the specification requirements. There may, however, be a few minor inaccuracies or inefficiencies. They will carry out simple routine operator maintenance tasks, requiring few operations and a limited range of tools and materials. They will work to the standard of a novice employee.

Learners will demonstrate acceptable workplace practice by working safely and in accordance with relevant legislation, ensuring that the workplace is cleared after task completion. They will demonstrate correct tool, material and equipment procedures, including selection, use, transport, maintenance and storage. Any waste materials will be disposed of in line with acceptable working practices.

Learners will give realistic but limited explanations of the options available for the servicing and repair of machinery, using some technical language.

Links to other units

This unit links to *Unit 24: Land-based Workshop Practices.*

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research and analysis skills
- working with others
- practical application when reflecting upon a brief
- safe working practices and procedures with regard to the use of land-based machinery.

Unit 24: Land-based Workshop Practices

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills needed to use facilities, tools and equipment to carry out machine maintenance and repair in a land-based setting.

Unit introduction

Keeping machines and equipment in good running order and carrying out repairs are often essential to their effective use. Many land-based settings have workshop facilities, tools and equipment to carry out these tasks in accordance with current legislative requirements and to meet environmental constraints.

In this unit, you will explore the facilities and equipment necessary to carry out maintenance and repair operations in a workshop setting. You will learn how to use equipment effectively and carry out repairs and maintenance tasks on a range of machines. You will learn how to use operator manuals to support these tasks and to obtain the relevant information.

This unit will support your progression to employment in the sector or to further study, which could be via an apprenticeship, for example in horticulture, or via a higher-education course, for example in areas such as land-based engineering or agriculture.

Learning aims

In this unit you will:

A Investigate the requirements for a land-based workshop used for the maintenance and repair of machinery and equipment

B Use workshop tools and equipment to complete a preparation task

C Carry out workshop maintenance and repair of land-based machinery to meet maintenance schedules.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the requirements for a land-based workshop used for the maintenance and repair of machinery and equipment	**A1** Workshop environment and materials **A2** Workshop tools and equipment – fixed and portable **A3** Laws/legislation and codes of practice	A report or presentation on resource and legislative requirements for a land-based workshop used for maintenance and repair.
B Use workshop tools and equipment to complete a preparation task	**B1** Safe and correct use of tools **B2** Correct tool maintenance and storage	A portfolio of evidence, to include: • correct use of tools and equipment in preparation for carrying out maintenance and repair of machinery, including cleaning and storage, for given tasks • use of workshop tools and equipment to maintain and repair machinery, meeting maintenance schedules, according to operator manual guidelines and required standards.
C Carry out workshop maintenance and repair of land-based machinery to meet maintenance schedules	**C1** Use of operator manuals for machinery to be repaired and maintained **C2** Selection and use of appropriate tools and equipment **C3** Organising and checking work	

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Content

Learning aim A: Investigate the requirements for a land-based workshop used for the maintenance and repair of machinery and equipment

A1 Workshop environment and materials

- Workshop environment:
  - secure, dry, clean, appropriate light levels, low fire risk
  - ease of access and emergency exit
  - provision of staff facilities, including washing, toilets, rest room, storage, telephone, computer
  - first-aid facilities, e.g. eye wash, bandages, plasters, clean wipes
  - appropriate waste disposal facilities and storage.
- Materials for use in maintenance and repair:
  - properties of materials, including malleability, tensile strength, ductility, ease of working, resistance to wear, rust resistance, rigidity/flexibility, low friction and insulation
  - metallic, e.g. ferrous, non-ferrous, alloys
  - non-metallic, e.g. thermosetting, thermoplastic, rubber, wood
  - selection, identification and correct use of materials
  - lubricants for drilling and cutting, and for gearboxes, chains and drive systems
  - anti-rust agents.

A2 Workshop tools and equipment – fixed and portable

- Fixed equipment:
  - equipment for drilling and sawing, e.g. pillar drills and powered band saws, powered hacksaws
  - equipment for support, e.g. benches, vices
  - lighting, heating and ventilation equipment.
- Portable equipment:
  - non-powered tools, e.g. hammers, hacksaws, files, spanners, wrenches, measuring devices, screwdrivers, scribers
  - powered tools, e.g. drills, grinders, polishers, cutters.
- Welding and associated cutting equipment:
  - manual metal arc (MMA) for horizontal welds
  - metal inert gas (MIG) for horizontal and vertical welding
  - oxyacetylene gas for welding and cutting, safe storage of gas.

A3 Laws/legislation and codes of practice

Current law and codes of practice:

- health and safety, safe use of chemicals, reporting of injuries, diseases and dangerous occurrences, safe lifting of loads
- general and specific risk assessment for safe working practices, use of tools, machinery and materials
- waste disposal requirements, e.g. storage, recycling, environmental and sustainability considerations.

Learning aim B: Use workshop tools and equipment to complete a preparation task

B1 Safe and correct use of tools

- Locating the correct manual:
  - online, hard copy.
- Identification of requirements:
  - identification of work task and order of work
  - referencing to index and chapter.
- Hand-held tools:
  - use of instruction manuals and personal protective equipment (PPE)
  - ensuring safe access, e.g. removal of guards, use of stands and work benches
  - dexterity and manipulation, e.g. correct handling of tools, including holding, use of whole blade, direction of use.
- Power tools:
  - use of instruction manuals and PPE
  - use of guards, guides and clamping devices
  - safe use of electricity, e.g. battery-operated tools, recognition of dangers of trailing cables, isolation of machinery, testing of electrical circuits, on/off switches and emergency cut-outs.
- Welding and cutting equipment:
  - dangers of use of electrical welders, e.g. in the wet, earthing, arc eye and fumes
  - dangers of use of gas welding equipment and gas storage
  - techniques for flat and vertical welding using electrical and gas welders
  - cutting techniques using gas torch.
- Personal protection:
  - ensuring use of safe working practices
  - PPE, including ear defenders, overalls, steel toecap boots/shoes, aprons, welding masks and eye protection, gloves
  - use of cut-offs, kill switches, removal of leads
  - use of holding equipment such as clamps and vices and equipment for support and to prevent movement, e.g. axle stands, blocks and wedges.

B2 Correct tool maintenance and storage

Correct maintenance and storage of tools to promote safety and efficiency.

- Maintenance of tools:
  - cleaning and lubrication
  - protection in storage
  - sharpening and periodic removal of effects of use, e.g. removal of burrs
  - replacement of wearing parts, e.g. saw blades, cutting and grinding discs, emery/sandpapers
  - periodic calibration and fault-finding.
- Storage:
  - storage environment, e.g. storage temperature and humidity, damp and rust prevention
  - material storage, waste matter storage and disposal, safe chemical handling and storage
  - stock control and replacement of used consumables and stock items.

Learning aim C: Carry out workshop maintenance and repair of land-based machinery to meet maintenance schedules

C1 Use of operator manuals for machinery to be repaired and maintained

- Machine manual:
  - hard copy or computer-based
  - telephone and online support
  - computer diagnosis.
- Service interval:
  - hours of use, period of time or mileage
  - use of charts and tables
  - updating of in-house records.
- Identifying solutions to maintenance issues:
  - use of index, online support, online manuals
  - correct model identification, e.g. date, part number, year of manufacture, registration
  - following identified procedures and pictures.

C2 Selection and use of appropriate tools and equipment

- Selection and use of appropriate tools:
  - identification of size required and unit of measurement, e.g. metric, imperial; Whitworth or AF
  - hand tools, e.g. spanners – ring spanner, torque wrenches, socket sets or open-ended spanners, adjustable, screwdrivers, to include flat and cross-headed, gauges and clamps
  - power tools, e.g. battery, mains – high and low voltage systems.
- Selection and use of appropriate equipment:
  - equipment for ease of access, e.g. stands, benches, boards, steps
  - lifting equipment, e.g. trolley jacks, bottle jacks, portable and static cranes and hoists
  - joining equipment, including welding, glueing and riveting.

C3 Organising and checking work

- Work organisation before start of maintenance or repair:
  - correct identification of procedures to be followed
  - timescales and tools/parts availability
  - location of work to be carried out, e.g. in a workshop or in a field.
- Work organisation in task:
  - selection and layout of appropriate tools, consumables and parts
  - ensuring access and effective order of work
  - storage of disassembled parts
  - appropriate waste collection and disposal to comply with relevant environmental and sustainability practices.
- Checking of work carried out:
  - checking work, including visual check, replacement of all disassembled parts and live test, including running up to full load and road/field test where applicable
  - updating of machine records, identification of next service interval
  - reordering of parts and consumables used.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate the requirements for a land-based workshop used for the maintenance and repair of machinery and equipment		**A.D1** Evaluate the relative importance of the identified requirements for a land-based workshop carrying out maintenance and repair.
A.P1 Explain the resource requirements for a land-based workshop used for maintenance and repair. **A.P2** Explain the relevant legislative requirements relating to maintenance and repair in a land-based workshop.	**A.M1** Analyse the resource and legislative requirements for a land-based workshop used for maintenance and repair.	
Learning aim B: Use workshop tools and equipment to complete a preparation task		**B.D2** Demonstrate highly accurate use of appropriate tools and equipment to carry out a complex preparation task to an agreed specification within an agreed timescale.
B.P3 Demonstrate competent use of appropriate tools and equipment to carry out a simple preparation task to an agreed specification. **B.P4** Maintain and store tools and equipment according to manufacturer's instructions.	**B.M2** Demonstrate efficient use of appropriate tools and equipment to carry out a complex preparation task to an agreed specification within an agreed timescale. **B.M3** Maintain and store tools and equipment efficiently according to manufacturer's instructions.	
Learning aim C: Carry out workshop maintenance and repair of land-based machinery to meet maintenance schedules		**C.D3** Perform, with a high degree of accuracy, a complex maintenance and repair task, checking and recording maintenance and repair operations carried out.
C.P5 Competently perform basic maintenance and repair operations on a machine. **C.P6** Competently check and record maintenance and repair operations carried out.	**C.M4** Perform maintenance and repair operations proficiently to undertake a complex maintenance and repair task. **C.M5** Demonstrate detailed checking and recording of maintenance and repair operations carried out.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, B.M3, C.M4, C.M5, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a suitable land-based workshop for the repair and maintenance of machines and equipment
- a range of suitable tools and equipment
- suitable PPE, including aprons, overalls, eye protection and safety footwear
- waste disposal facilities
- a selection of machines and equipment for repair and maintenance.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will produce a thorough account of the requirements for a land-based workshop for machine repair and maintenance, showing a depth of understanding of the facilities, tools and equipment needed. Learners will review both the positive and negative requirements of a workshop and of suggested equipment. They will justify a comprehensive list of staff facilities, including first-aid equipment, and produce well-reasoned comments on their relative importance and use. Learners will show insightful understanding of efficient and legal waste disposal requirements and recommend well-reasoned solutions. They will demonstrate a depth of understanding of the legislation and codes of practice relating to working within a workshop environment used for repair and maintenance of machines and equipment. Learners will consider the potential use of materials thoroughly, with a robust evaluation of the advantages and disadvantages of each. The evidence will include convincing findings, showing a high level of reasoning, be technically accurate and fully relevant. It will be clear that learners have a complete understanding of workshop requirements and how to decide on these requirements.

For Merit standard, learners will make mainly relevant, analytical judgements on the identified requirements for a land-based workshop for machine repair and maintenance, showing a clear understanding of the resources required. The requirements must cover physical requirements, tools and equipment, and resources for the staff, including first-aid equipment, using the workshop. Learners will make a clear assessment of a range of materials that might be used within a workshop, with a balanced and mainly relevant analysis of the advantages and disadvantages of each. They will show breadth and some depth of knowledge of the relevant legislation and codes of practice. Learners will assess a range of waste disposal options, relating them to sustainability issues and giving mostly valid solutions. The evidence will be mostly technically accurate and relevant and show that learners have a clear understanding of workshop requirements.

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For Pass standard, learners will give a limited, realistic account of the requirements for a workshop for machine repair and maintenance in terms of facilities, tools and equipment. They will demonstrate some relevant understanding of the physical requirements for a workshop, and correctly identify suitable first-aid equipment. Learners will show a realistic awareness of suitable ways to dispose of waste materials. There will be a basic understanding of the materials and the range of fixed and portable equipment that might be used in the repair and maintenance of machinery, with basic explanations of suitable equipment. This will be supported by limited examples of what the equipment might be used for. Learners will recall basic knowledge of relevant legislation and codes of practice. The evidence will include some technical accuracy and relevance, but there may be omissions, and show a realistic awareness of workshop requirements.

Learning aims B and C

In order to achieve learning aims B and C, learners must provide evidence that they have used at least one type of each of the following tools: hand tool, power tool, welding equipment, cutting equipment. Teachers should ensure that the tasks selected by learners provide sufficient scope for them to fully complete the assessments.

For Distinction standard, learners will use the specified range of tools and equipment to perform complex tasks to a very high standard and fully meet the objectives of a given brief. In carrying out the preparation task, there will be evidence of learners having developed the relevant practical skills and safety awareness required to subsequently take on a complex maintenance and repair task with a high degree of accuracy and insight.

Learners will carry out confidently both the practical preparation task and the actual maintenance and repair task, showing a high degree of initiative within the limits of their responsibility. All the tasks will require multiple operations and the use of a variety of hand and powered tools and equipment. Learners will demonstrate a robust understanding of how to look after tools and equipment to a very high standard. They will accurately select and use appropriate tools and equipment to maintain and repair land-based machinery proficiently and to a standard that reflects best workplace practice. The work will be carried out with efficient use of the relevant operator manuals and will be technically correct. Learners will investigate thoroughly the machine both before work, in order to identify issues and produce robust solutions, and after the work is carried out, to check satisfactory completion. All work will be carried out in a sensible, logical order, demonstrating learners' confidence and proficiency.

Learners will demonstrate highly efficient workplace practice by working safely and accurately in accordance with relevant legislation, ensuring the workplace is cleared after task completion. They will provide evidence of effective strategies used to minimise risks. Through the work carried out, they will demonstrate breadth and depth of understanding of practices that relate to environmental issues and sustainable waste disposal. Learners will keep detailed and accurate records as appropriate to the tasks being carried out.

For Merit standard, learners will use the specified range of tools and equipment to perform complex tasks safely and efficiently. In carrying out the preparation task, there will be evidence of learners having developed the relevant practical skills and safety awareness required to subsequently take on a complex maintenance and repair task with efficiency.

Learners will efficiently carry out both the practical preparation task and the actual maintenance and repair task to meet given objectives, and show some initiative within the limits of their responsibility. They will demonstrate mostly relevant and accurate knowledge and skills. The tasks will require multiple operations and the use of a variety of hand and powered tools and equipment. Learners will demonstrate breadth of understanding of how to look after tools and equipment safely and effectively, minimising resource wastage. They will select and use tools and equipment to maintain and repair land-based machinery safely and efficiently. Learners will show clear understanding in their use of operator manuals. They will investigate the machine both before work, in order to identify issues and produce clear, mainly relevant solutions, and after the work is carried out, to check satisfactory completion. Tasks will be undertaken competently and efficiently, meeting most of the identified requirements.

Learners will demonstrate proficient workshop practices by working safely in accordance with legalisation and codes of practice and ensuring after-use cleaning, maintenance and storage. Learners will assess the associated risks and hazards in a mainly relevant manner. They will organise their work and carry out tasks in a mostly logical sequence, which they will be able to explain clearly. Through the work carried out, they will demonstrate breadth and some depth of understanding of some practices that relate to environmental issues and sustainable waste disposal. Learners will keep records as appropriate to the tasks, with sufficient detail so it is clear what has been carried out.

For Pass standard, learners will use the specified range of tools and equipment to carry out simple tasks safely and competently, although some minor errors may occur. In carrying out the preparation task, there will be evidence of learners having developed the relevant practical skills and safety awareness required to subsequently take on a complex maintenance and repair task competently.

Learners will carry out both the practical preparation task and the actual maintenance and repair task competently, but show little initiative within the limits of their responsibility. Learners will demonstrate a basic understanding of how to look after the tools and equipment. They will use the appropriate tools and equipment to carry out maintenance and repair, following an agreed specification and with some supervision. Learners will show that they can use operator manuals to assist in their repair and maintenance of machines and equipment. They will carry out basic checks of the machine before work, in order to identify issues and produce realistic but limited solutions, with some supervision. Learners will check the work carried out, but this may be limited and lacking in depth and understanding. Tasks will be carried out safely and meet the key aspects of the given specification.

Learners will demonstrate safe workshop practice and comply with relevant legislation and codes of practice, ensuring some after-use cleaning, maintenance and storage. Learners will show a realistic awareness of the risks and potential issues that could arise. They will demonstrate limited understanding of determining sensible sequences of work. Through the work carried out, they will demonstrate superficial but realistic understanding of practices that relate to environmental issues and sustainable waste disposal. Learners will show an appropriate awareness of the importance of keeping the required records and providing the key information.

Links to other units

This unit links to:

- Unit 2: Estate Skills
- Unit 7: Work Experience in the Land-based Sectors.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills when investigating legal requirements in a working environment
- personal skills when working with others
- self-management and planning skills when working with land-based machinery.

Unit 25: Selecting and Managing Land-based Machinery

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners study all aspects of selecting and managing a range of machinery, from initial choices, procurement, funding and operating costs to ensuring and monitoring effective and efficient use.

Unit introduction

Machinery is essential to many land-based industries and can account for a very high proportion of the fixed costs for an enterprise. It is, therefore, essential that the correct decisions are made in the selection and management of this machinery and associated equipment. Costs can be significantly reduced by the correct specification, selection and procurement of machinery. In a world where machines are performing a rapidly increasing number of manual labour tasks, operator productivity and efficiency is extremely important.

In this unit, you will explore the decision-making processes in the selection of land-based machinery. You will explore alternatives to the outright purchase of machinery, such as the use of contractors and machine hire. You will investigate the legislation relevant to the use of machinery, and learn how to estimate and monitor the use of machinery to ensure its maximum effectiveness. The efficient management of machinery is key to the economic viability of a land-based enterprise and this unit will help you to develop the skills associated with estimating machinery costs. The unit provides you with an opportunity to undertake an investigation of the costs and efficiency of using machinery for a land-based operation.

The skills that you learn in this unit are key to employment in the sector at supervisor level and above, and will also support your progression into an apprenticeship or to a higher-education establishment.

Learning aims

In this unit you will:

A Investigate factors influencing the selection and procurement of land-based machinery

B Produce a plan for the efficient and legal use of machinery for a land-based enterprise

C Calculate the costs and efficiency factors of procuring and using machinery for a land-based task.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate factors influencing the selection and procurement of land-based machinery	**A1** Required specifications **A2** Factors influencing procurement decisions **A3** Common procurement and replacement options	A specification for a machine, including an evaluation of the factors affecting the selection of suitable machinery and the options for procurement.
B Produce a plan for the efficient and legal use of machinery for a land-based enterprise	**B1** Operator and on-the-road legislation, and the role of operator competence **B2** Planning the monitoring of a machinery operation	A plan for monitoring the performance and efficiency of use of a machine, including consideration of legal and operator competence, along with an evaluation of its effectiveness. Evidence of use of techniques to assess the performance of a machine and calculation of associated costs.
C Calculate the costs and efficiency factors of procuring and using machinery for a land-based task	**C1** Monitoring machinery performance **C2** Procurement costs **C3** Operating, maintenance and servicing costs	

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Content

Learning aim A: Investigate factors influencing the selection and procurement of land-based machinery

A1 Required specifications

- Accurately describing the performance of an engine:
  - the concepts of energy, work, force, power, torque and torque backup
  - metric and imperial units of measurement and their conversions
  - how power is measured, including use of dynamometer and engine power ratings
  - methods of indicating power output, including claimed engine power, maximum engine power, take-off power and drawbar power
  - torque and its relationship to engine speed, gearing, and the importance of torque backup.
- Power unit specification:
  - relevant aspects of engine performance, e.g. power output, fuel consumption and efficiency, fuel capacity
  - external services, e.g. hydraulic performance, power take-off (PTO) options
  - ergonomics and working conditions and their effect on operator productivity
  - dimensions, e.g. width, height, length, weight
  - compatibility with existing machines
  - fit for purpose, e.g. requirements of the task, topography, slopes, weather.
- Machinery specification:
  - power requirements
  - fitness for purpose, e.g. working width, capacity, dimensions, ease of operator use, complexity, road-legal
  - other considerations, e.g. specialist attachments, electronics, height/width restrictions.

A2 Factors influencing procurement decisions

- Establishing whether the machine suits and fits the working environment, e.g. considerations relating to size, width, height and weight, access to buildings, use of roadways, field entrances, weight in use and stability on slopes.
- Compatibility with power unit, for mounted and attached equipment, e.g. equipment power requirement compared to engine power available.
- Compatibility with and similarity to other machines already in use, e.g. same manufacturer, similar operating systems, working widths, rates of work.
- Understanding the types of procurement error that should be avoided, including untried machine, incompatibility, lack of operator skills, non-availability of spares.
- Revising requirements in line with machines available for procurement.
- Performance:
  - fuel consumption, rate of work
  - environmental and sustainability factors, e.g. fuel type and consumption rate, air and noise pollution, recycling of products, machine lifespan
  - minimising soil damage and compaction, e.g. use of correct tyres, machine weight, timing of work, seasonality.

- Dealership considerations:
  - proximity of dealer, dealer backup, dealer availability, availability of spares and potential downtime.
- After-sales support:
  - maintenance and servicing
  - warranty and guarantees.
- Financial factors, e.g. cost, value for money, running costs, fuel costs, spares, reputation, servicing and repair.

A3 Common procurement and replacement options

- Procurement options:
  - direct purchase
  - sources of finance, e.g. manufacturers' schemes, bank loans, hire purchase
  - contract hire, leasing
  - purchase of used machinery
  - alternatives to purchase, e.g. use of contractors and machine hire
  - sharing machinery, cooperatives, and machinery rings, including formal and informal arrangements.
- Replacement options:
  - estimation of value of used machinery or exchange value
  - new versus used
  - replacement policy and timing.

Learning aim B: Produce a plan for the efficient and legal use of machinery for a land-based enterprise

B1 Operator and on-the-road legislation, and the role of operator competence

- The law:
  - minimum age requirements for use of machinery
  - fitness for purpose
  - with regard to use of machinery on the road, including fitness for purpose, widths, road speed, combination weights (gross train weight), lengths, signage and lighting for road use
  - with regard to adequate training for use and the use of personal protective equipment (PPE)
  - health and safety.
- Operator competence:
  - certificates of competence, e.g. spraying, chainsaw use
  - training plans
  - compulsory and recommended training, e.g. telescopic handles, tractor driving, all-terrain vehicles (ATVs)
  - informal training
  - insurance requirements.

B2 Planning the monitoring of a machinery operation

- Identification of operation to be carried out, e.g. size, complexity, timescale, required rate of work, field pattern, turning techniques, limitations, timing and seasonality.
- Key monitoring factors and how the monitoring will be carried out, e.g. rate of work, field efficiency, observation, use of recorded data.

- Use of work study to systematically, objectively and critically examine all factors affecting the operation.
- Use of data information systems to assist machinery management:
  - how data information systems work and are used
  - guidance systems, e.g. Global Positioning System (GPS)
  - using electronic systems for the purposes of crop monitoring and processing harvesting information
  - satellite information, including ground cover, pesticide or fertiliser issues
  - use of photography for recording and analysis.

Learning aim C: Calculate the costs and efficiency factors of procuring and using machinery for a land-based task

C1 Monitoring machinery performance

- Machinery performance:
  - machine capacity, e.g. field capacity, material capacity
  - unused capacity, travel time, downtime, preparation time.
- Work rate and efficiency, e.g. spot rate, field efficiency, seasonal efficiency.
- Cost of operation, e.g. labour, fuel, spares, consumables.

C2 Procurement costs

- Machine purchase cost:
  - deposit and payment schemes, overall cost of payment schemes
  - length of purchase
  - opportunity cost of the procurement funds and what else the procurement funds could be used for
  - opportunity cost of the management time.
- Costs of other methods of obtaining machinery, e.g. hiring, renting, use of contractors, subcontracting, machinery rings and cooperatives.

C3 Operating, maintenance and servicing costs

- Depreciation:
  - calculation, e.g. straight line, diminishing returns.
- Interest:
  - calculation, e.g. average value, real interest rates.
- Service and repair costs:
  - fuel
  - servicing
  - managing repair costs, e.g. through recording, estimating, predicting.
- Other costs:
  - tax, insurance, storage, labour
  - opportunity cost associated with operating maintenance and servicing, considering what else could be done with the funds or labour required for maintenance and servicing.
- Whole-life costs:
  - estimated life
  - resale value
  - indirect costs, e.g. downtime and transport.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate factors influencing the selection and procurement of land-based machinery		
A.P1 Produce a basic specification for a machine for a land-based operation. **A.P2** Explain the decision-making process involved in the procurement of a machine.	**A.M1** Produce a complete specification for a machine for a land-based operation. **A.M2** Analyse the decision-making process involved in the procurement of a machine.	**A.D1** Produce a comprehensive specification for a machine, evaluating the relative importance of factors influencing procurement.
Learning aim B: Produce a plan for the efficient and legal use of machinery for a land-based enterprise		
B.P3 Explain the significance of legal and competence requirements in monitoring the use of a machine for a land-based operation. **B.P4** Produce a basic plan for monitoring the efficiency of use of a machine for a land-based operation.	**B.M3** Justify choices made in developing a detailed plan for monitoring the efficiency of use of a machine for a land-based operation.	**B.D2** Produce a comprehensive plan for monitoring the efficiency of use of a machine for a land-based operation, evaluating its effectiveness.
Learning aim C: Calculate the costs and efficiency factors of procuring and using machinery for a land-based task		
C.P5 Demonstrate competent use of techniques to measure the performance of a specified machine for a land-based operation. **C.P6** Calculate the costs associated with operating a specified machine in work.	**C.M4** Demonstrate proficient use of techniques to measure the efficiency of use of machinery in work, including calculation of costs.	**C.D3** Demonstrate highly accurate use of techniques to assess the performance of a machine in work, including calculation of costs.

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M3, C.M4, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of machines and equipment
- operator manuals, buyer guides and access to technical information on the machines and equipment
- suitable in-field location and field tasks for study
- stopwatches
- machinery costings.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will produce a comprehensive, accurate specification, which is supported by logical reasoning and contains no irrelevancies. They will demonstrate an in-depth understanding of the concepts of work, power, torque and torque backup, their interrelationship, and how torque and power change with engine speed changes. They will thoroughly evaluate the importance of a complete range of specification requirements for a machine for an identified task. Learners will be able to prioritise elements of the specification in a logical manner, giving comprehensive, well-reasoned justifications for doing so.

Learners will thoroughly consider the significance of factors involved in the process of procuring a machine in a land-based context. They will demonstrate breadth and depth of knowledge of the links between the various factors involved in the decision-making process, including performance, dealer reputation and proximity, value for money, and previous models owned. Considered, detailed arguments will be given to justify the decision made for a suitable machine and the procurement options available.

Learners will make insightful references to performance requirements and procurement opportunities. Decisions will be supported by evidence such as buyer guides, recommendations and investigation of similar operations. They will comprehensively evaluate low-impact, economy and sustainability issues.

Learners will be consistent and accurate in their use of specialist terminology.

For Merit standard, learners will produce a complete specification that is accurate, clear and contains mostly relevant decisions and justifications. They will explain and justify the specification in a mainly logical way. They will give a solution that is suitable and technically accurate. Learners will explore the concepts of power and torque and their relationship to engine speed, but explanations may be limited in depth or breadth. They will show clear knowledge and understanding of the factors affecting decisions regarding the specification of a machine for a task and the options for procurement. Learners will show some evidence of prioritising elements of the specification.

Learners will give a clear, balanced analysis of the decision-making processes relevant to the procurement of a machine. They will make mainly relevant references to the various factors influencing the procurement.

Learners' level of understanding and analysis will be that of a competent employee. They will use specialist terminology appropriately.

For Pass standard, learners will produce a basic specification that is realistic but limited in scope and it may contain some irrelevant aspects. They will demonstrate a realistic but undeveloped understanding of the concepts of work, power and torque, and will be able to explain these in simple terms. Learners will show some understanding of a basic range of factors to consider when deciding on the specification of a machine, including requirements for the tasks, engine power and compatibility. They will explore the requirements of machine for a task and be able to explain them to a supervisor. Learners may make limited use of supporting information sources and documentation. They will show realistic, limited understanding of the options available for obtaining a machine but the explanations will be mainly generic or contain some irrelevancies. Learners will be able to explain some relevant factors that might affect the final decision-making process; these will be appropriate but explanations will be undeveloped.

The evidence will be limited in scope or generic in parts but will be mostly appropriate, with some undeveloped references to sustainability. The evidence will show some use of appropriate specialist terminology.

Learning aims B and C

For Distinction standard, learners will produce a comprehensive plan for monitoring the performance and efficiency of a machine for a land-based operation. They will thoroughly investigate a field-based operation and report on its efficiency, using a comprehensive range of efficiency measures and techniques. Learners will show breadth and depth of skills and knowledge in considering, prioritising and evaluating the relevance of each efficiency measure. Learners will make effective use of standard management data and comprehensive comparisons will be made. Suitable and logically justified suggestions will be given regarding ways to improve the efficiency of the operations investigated.

Learners will demonstrate highly accurate use of a range of techniques to assess the performance of a machine in work. They will work legally and safely at all times.

Learners will accurately calculate, without errors, the costs of the operation under investigation, including procurement, operating and maintenance costs. They will show insight in examining the legal and operator requirements of the task carried out and link their findings logically to the overall use of efficiency measures and techniques. Learners will correctly identify and evaluate the use of data information collection systems in monitoring the efficiency of field operations.

Learners will give well-reasoned justifications for all their recommendations, demonstrating a detailed awareness of the influence of all of the different aspects of the operation in affecting the efficiency of the tasks.

Learners will use appropriate specialist terminology consistently and accurately throughout.

For Merit standard, learners will produce a detailed plan to monitor the efficiency of a field operation and apply it to a real operation. They will produce clear and mainly accurate efficiency data and compare this to available management data. The plan will contain all key information and show detailed understanding of factors that might affect the efficiency of the operation, giving appropriate but partially developed reasons for choices made. Learners will make mostly accurate references to the legal and operator requirements for the operation.

Learners will demonstrate a clear understanding of most of the factors that might affect the efficiency of an operation and will be able to prioritise them. They will assess the suitability of a range of data information systems in monitoring a field operation and their use. Judgements will be clear and analytical, showing understanding of most of the components of the operation.

Learners will demonstrate proficient use of techniques for measurement of the efficiency of use of a machine for a land-based task, working safely and legally at all times. Calculation of costs will be mainly accurate, but some costs may be missed out.

Learners will work to the standard of a competent employee. They will use appropriate specialist terminology throughout, but this may be inconsistent.

For Pass standard, learners will identify and explain basic factors that affect the efficiency of use of machines for tasks in a field situation. They will show realistic understanding of the application of these measures to a real task. Learners will apply a limited number of simple efficiency measures to a task and report on the overall efficiency of the operation; some factors will be omitted and the report will be generally accurate, but undeveloped or generic in parts. They will explain the legal and operator requirements relevant to such use, but may not relate these requirements to the overall monitoring of the machinery.

Learners will produce a basic plan for monitoring the efficiency of use of a machine for a given land-based operation. The plan will be undeveloped but realistic, showing limited breadth and depth of understanding of the principles for measuring the efficiency of machines.

Learners will demonstrate competent measurement of the performance of a machine for a land-based task and work safely and legally at all times.

Basic costs of purchasing, operating and maintaining a machine for a task will be calculated with some accuracy but may be incomplete. Learners will make limited use of supporting information and management data. They will show a realistic but undeveloped awareness of data information systems that may be used to monitor the efficiency of operations in the field. Learners will give explanations for the efficiency measures used, but these may be limited in scope. Learners will work to the standard of a novice employee.

The evidence will show some use of relevant specialist terminology but there may be omissions.

Links to other units

This unit links to:

- Unit 4: Developing a Land-based Enterprise
- Unit 23: Land-based Machinery Operations.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills
- presentation and interpersonal skills when working with others
- analytical and evaluative practices when investigating the efficiency of land-based machinery
- mathematical skills and knowledge when calculating costs.

Unit 26: Applied Agricultural Farming Practice

Level: **3**
Unit type: **Internal**
Guided learning hours: **120**

Unit in brief

Learners develop knowledge and skills relating to crop production and farm livestock systems in order to develop a farm management plan.

Unit introduction

Successful farm production requires careful consideration of resources, a broad knowledge of professional farm working practice and well-developed practical skills in crop production and animal husbandry. Being able to independently select and apply knowledge and skills for farm production is essential for anyone working in the agriculture sector.

In this unit, you will produce a farm practice management plan that aims to develop farm productivity levels. You will draw on your broader knowledge and understanding of agricultural practice, along with new specialist knowledge and skills developed in this unit relating to crop production, and livestock production and husbandry. Your management plan will consider all aspects of the production cycle, including animal welfare, nutrition and handling, crop maintenance, harvesting and storage, and it will identify opportunities and suggest strategies for improving productivity.

This unit includes the key vocational assessment task of evaluating farm practices and developing a farm practice management plan aiming to achieve optimum productivity levels. You will need to select and apply knowledge and skills developed in your study of the mandatory content and your wider learning from across the programme.
You will select and apply your knowledge and skills from *Unit 1: Plant and Soil Science*, *Unit 2: Estate Skills* and *Unit 23: Land-based Machinery Operations*. You will also use your experience of real work practices in the sector from *Unit 7: Work Experience in the Land-based Sectors*.

This unit will give you the skills to independently manage farm production of crops and animals in a professional way. These skills will give you an advantage in progressing to employment in a role such as general farm worker, livestock assistant or assistant crop trials officer. The skills will also help you to progress to general employment in a mixed farming setting and to further study in an apprenticeship or higher education.

Learning aims

In this unit you will:

A Explore and maintain healthy crop production

B Investigate livestock systems and perform animal husbandry tasks

C Review farm practice and opportunities for production

D Produce a farm practice management plan to develop farm productivity levels.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore and maintain healthy crop production	**A1** Crop plants and their products **A2** The principles of crop establishment and cultivation **A3** The principles of maintaining healthy crops **A4** Safe harvesting and storage of crops	A portfolio of evidence on the practical production of crops including: preparation, maintenance, harvest and storage.
B Investigate livestock systems and perform animal husbandry tasks	**B1** Farm livestock types and breeds **B2** Livestock production systems **B3** Managing the welfare of farmed livestock	A portfolio of evidence on the practical husbandry of livestock including: handling, feeding and nutrition.
C Review farm practice and opportunities for production	**C1** Agricultural practice parameters for evaluation **C2** Evaluating farm needs and opportunities	A written or presented farm practice evaluation and management plan, supported by a farm audit.
D Produce a farm practice management plan to develop farm productivity levels	**D1** Farm practice management plan	

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Content

Learning aim A: Explore and maintain healthy crop production

Learners develop knowledge of the characteristics and purpose of crop species grown commercially.

A1 Crop plants and their products

- Annual, biennial, perennial crops.
- Identifying crop types, including:
  - cereals, e.g. wheat, barley, oats, rye, triticale
  - oilseeds, e.g. oilseed rape, linseed
  - forage crops, e.g. grass, maize
  - root crops, e.g. sugar beet, fodder beet, potatoes
  - vegetable crops, e.g. brassicas, salad crops
  - legumes and pulses, e.g. peas, beans
  - fruit, e.g. top, soft
  - minor and specialist crops, e.g. miscanthus, borage, canary seed.
- Selection of cultivars for different production needs.

A2 The principles of crop establishment and cultivation

Learners will investigate the requirements for successful foundations of crop growth and determine the different types of cultivation used in crop production.

- Target populations, seed rates and plant spacing.
- Timing of establishment, e.g. autumn or spring.
- Crop establishment systems.
- Cultivation and establishment machinery.
- Crops rotations and cropping sequence.
- Seedbed conditions, planting depth and the importance of seed-soil contact.
- Seed dressings.
- Climate, topography and soil type.

A3 The principles of maintaining healthy crops

- Recognising growth and development stages.
- Control of weeds, pests and diseases including:
  - cultural, physical, chemical and biological control
  - effect on yield and quality.
- Crop nutrient requirements and calculating plant nutrient requirement, including:
  - major nutrients (nitrogen, phosphate, and potassium [potash], sulfur, magnesium)
  - minor and trace elements, e.g. boron, manganese.
- Recognising crop nutrient deficiencies.
- Soil management, e.g. waterlogging, nutrient levels, soil pH.
- Sources of plant nutrients, including:
  - organic fertilisers
  - inorganic fertilisers.

- Specific current relevant legislation and codes of practice relating to crop production.
- Manipulating plant growth, e.g. plant growth regulation, planting timings.
- Ripening and crop maturity.
- Crop protection methods, e.g. plastic, polytunnel.

A4 Safe harvesting and storage of crops

Learners will investigate all aspects of the crop production cycle, from establishment and crop nutrition through to harvesting and storage.

- Pre-harvest management, e.g. desiccation, dehaulming.
- Harvesting methods for combinable crops, fresh crops and manual harvesting.
- Health and safety considerations in the crop store, including:
  - contact with dust, prevention of illnesses, e.g. farmer's lung
  - personal protective equipment (PPE) requirements
  - potential hazards.
- Key aspects in safe storage of fresh and dry products, including:
  - methods of conditioning crops in store and the use of additives
  - effect of storage on crop quality, e.g. temperature control
  - control of storage pests, diseases and vermin
  - food safety requirements, e.g. assurance schemes
  - storage timings, e.g. short term, long term, cooperative storage.
- Store hygiene monitoring.
- Crop segregation and the reasons why crops are segregated.
- On-farm use of crops and crop by-products.

Learning aim B: Investigate livestock systems and perform animal husbandry tasks

B1 Farm livestock types and breeds

Learners will examine the characteristics and purposes of common livestock breeds, including native and imported.

- Sheep for food, wool and by-products, including pure-bred and cross-bred sheep, e.g. Border Leicester, Suffolk, Jacob, Lincoln Longwool, Texel, Charolais.
- Poultry for meat, eggs and by-products, hybrid and pure breeds, e.g. Buff Orpington, Araucana, Legbar, Faverolles, Aylesbury ducks.
- Cattle for beef, dairy, and by-products, e.g. Hereford, Red Poll, Longhorn, Angus, Welsh Black, Galloway, Jersey, Limousin.
- Goats for milk, meat and by-products, including hybrid and pure breeds, e.g. Bagot, British Toggenburg, Golden Guernsey, Angora and British Primitive goats, Saanens.
- Unconventional livestock diversification, e.g. ostriches for meat, alpacas for fleece.

B2 Livestock production systems

Learners will understand the different types of production system such as intensive, organic, semi-intensive, extensive and mega-farming, and will know the different categories in each system.

- Variety and characteristics of common production systems for common livestock and standards of welfare and quality of product produced:
  - poultry (broilers, laying hens)
  - cattle (beef and dairy)
  - sheep (lowland, upland, hill)
  - fish (extensive and intensive).
- Class of stock, ages of stock, length of time animals are in production cycle.

B3 Managing the welfare of farmed livestock

Learners will understand the relationship between high levels of animal welfare, and a well-run productive business; including the key requirements for feeding and housing livestock.

- Feeding and watering:
  - feed types, straights, blends, compound feed, concentrates, forage and fodder
  - hay, haylage, silage and straw production
  - nutrient requirements for farm species
  - palatability of feeds and impact on behaviour
  - feeding and watering equipment from protocols for livestock species, including:
    - automatic drinkers
    - troughs, buckets, feeders, racks and automated systems
  - developing productive feeding protocols for livestock species to maximise the value of the animal, including:
    - storage of feeds, including regulations and practical considerations
    - preparation of feed
    - hygiene
    - personal protective equipment (PPE).
- Accommodation considerations, including:
  - design and maintenance of indoor and outdoor accommodation, and the impact on animal welfare, including size, space, ventilation and security
  - legislation and codes of practice specific to accommodation, including:
    - space allocations
    - animal needs
  - disposal of waste:
    - organic, e.g. manures
    - inorganic, e.g. feed bags.

- Animal handling, including:
  - practical handling, restraining and equipment use such as tethers, halters, ropes, bull poles, boards, paddles, flat slap sticks, electric fencing, crushes, yoke units, pens, hurdles, crates, cattle races
  - use of weighing scales
  - practical techniques of handling and restraining in different locations, including:
    - safe use of equipment
    - correct restraining methods for size of animal
    - loading and unloading
    - safety considerations and risk management.

Learning aim C: Review farm practice and opportunities for production

In undertaking the key vocational task of reviewing, evaluating and planning the management of farm practices, learners must select and apply learning from *Unit 2: Estate Skills, Unit 7: Work Experience in the Land-based Sectors* and *Unit 23: Land-based Machinery Operations*.

C1 Agricultural practice parameters for evaluation

Learners reflect on their application of crop production and animal husbandry skills, and consider opportunities for their professional and practical development of farming skills.

- Parameters for evaluating the impact of professional practice on farm production, including:
  - following processes and procedures
  - the impact of waste management on farm products
  - use of equipment and the impact on farm products
  - response to risks and hazards
  - maintaining the standards and meeting the quality requirements for farm assurance schemes
  - the impact of knowledge of the business and or/environment on practice
  - the impact of communication and reporting on productivity
  - completion of activities and cooperation when working with crops and animals
  - management of own role, responsibility and reliability
  - ongoing reflection and use of feedback to inform development
  - self-assessment techniques.
- Use of ongoing assessment during practice, including:
  - visual health assessments
  - behavioural assessments, including species-specific behaviour, patterns, interaction with other animals
  - recognising healthy and unhealthy crops, e.g. crop growth stages
  - recognising growth and development stages
  - recognising crop nutrient deficiencies
  - use of remedial action.

- Farm production monitoring, including:
  - yield, tonnes per hectare (t/ha)
  - visual and routine inspection of quality
  - quality of produce
  - slaughter weight
  - breeding records
  - veterinary medicine use impact
  - store hygiene monitoring
  - test results for accuracy, e.g. soil tests, milk testing.

C2 Evaluating farm needs and opportunities

- Audit and inventory of farm productivity, including:
  - current levels of productivity, e.g. output per hectare
  - infrastructure assessment, e.g. buildings and machinery, location
  - resource inventory, land, buildings, cropping and livestock numbers
  - quality review of current products
  - processes and aids to planning activities, including technology, budgets, schedules and flow charts
  - assessing ranges and quantities, e.g. use of maps, diagrams, plans, measurements, estimates
  - SWOT analysis, including:
    - unique features, point of difference
    - organisational characteristics
    - staffing
    - resources
    - capacity of land or facilities, soil type and fertility level
    - developments in market trends
    - changes in social patterns, populations and lifestyle changes
    - new emerging technology
    - government policy changes
    - local competitors
    - introduction of quality standards and specifications
    - competition
    - internal factors
    - external factors.

Learning aim D: Produce a farm practice management plan to develop farm productivity levels

D1 Farm practice management plan

- Aims and objectives of plan, covering:
  - identifying the plan
  - reasons for conducting the plan
  - legitimacy of the plan.
- Land, building or facilities required:
  - soil type, topography and cropping
  - buildings and accommodation.

- Pest and disease strategy, covering:
  - pest problems, threshold levels, current issues.
- Fertiliser and feeding strategies:
  - fertiliser nutrition strategy:
    - legislative considerations, e.g. Nitrate Vulnerable Zones (NVZ) areas
    - fertiliser sources, e.g. natural, artificial
  - animal feeding:
    - feeding for growth.
- Accommodation strategy:
  - indoor systems, e.g. buildings
  - outdoor systems, e.g. land space and field use.
- Waste strategy:
  - disposal of waste products, including recycling and reusing.
- Equipment required, sources and suppliers' materials and supplies, including:
  - feed supplier
  - animal health product supplier
  - seed supplier
  - fertiliser supplier.
- Schedule, e.g. 1-, 2- and 3-year plan, regular tasks, one-off task.
- Quality parameters, including:
  - animals, e.g. carcass conformation
  - crops, e.g. moisture, protein, admixture.
- Maintenance plan for facilities and equipment:
  - regular maintenance, e.g. boundaries, roofing and structural work.
- Production strategy, e.g. specialisation, capacity expansion, integration of processing, diversification.
- Regulations and licensing, including:
  - application of pesticides, legal requirements for pesticide application (licences)
  - sources of certified seed, UFAS certification
  - ethical and moral considerations
  - animal welfare
  - recommended codes of practice
  - laws/legislation linked to the welfare of animals
  - legal use of veterinary medicines.
- Risk assessments for human and animal welfare, including:
  - assessing risks and identification of hazards, e.g. animals, equipment and people
  - minimising the impact of hazards, including legislative responsibilities.
- Inspection and auditing frequency, type and recording strategy, including:
  - farm assurance schemes
  - regular inspection and monitoring of crops for weeds, pests and diseases
  - daily checking of livestock
  - remedial action.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Explore and maintain healthy crop production		
A.P1 Explore the characteristics of different crops, key requirements for crop establishment and cultivation methods. **A.P2** Safely carry out crop monitoring, harvesting and storage of a given crop to promote healthy crops.	**A.M1** Analyse the parameters that influence the production, quality and yield of crops. **A.M2** Apply competent management principles for the production of healthy crops, including remedial action.	**A.D1** Evaluate and justify the effectiveness and efficiency of crop production practice and the impact of crop management and storage on the productivity and quality of the system.
Learning aim B: Investigate livestock systems and perform animal husbandry tasks		
B.P3 Assess the characteristics of different production systems, their breeds and products, considering the impact on welfare. **B.P4** Apply appropriate nutritional practice for livestock, based on investigation of nutritional requirements for farm livestock and the relationship to quality produce. **B.P5** Select and apply safe and appropriate handling and restraining techniques, and use of equipment to maintain the welfare of livestock.	**B.M3** Analyse the factors that determine the quality of livestock in the production system for farm livestock within own practice. **B.M4** Demonstrate efficient and correct handling and restraining techniques while maintaining livestock health and welfare.	**B.D2** Effectively practise animal husbandry, showing confident understanding of the factors that impact welfare and quality of produce through review of own performance.

Pass	Merit	Distinction
Learning aim C: Review farm practice and opportunities for production		**CD.D3** Produce a feasible and effective farm production management plan and justify how decisions will increase productivity, based on critical evaluation of agricultural farming practice.
C.P6 Assess for signs of impact on welfare, health and deficiency of agricultural products within own practice. **C.P7** Appropriately inspect the suitability of a farm production process to increase productivity.	**C.M5** Carry out effective farm production monitoring systems with a high degree of accuracy, evaluating the impact of farming practice on productivity.	
Learning aim D: Produce a farm practice management plan to develop farm productivity levels		
D.P8 Produce an appropriate farm production management plan that selects and applies farm practice skills.	**D.M6** Produce a competent farm production management plan, based on inspection, assessment and comparison of current farm production.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of three summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aim: B (B.P3, B.P4, B.P5, B.M3, B.M4, B.D2)

Learning aims: C and D (C.P6, C.P7, D.P8, C.M5, D.M6, CD.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- farm livestock
- animal handling equipment
- a range of crops for regular inspection
- crop storage facilities
- personal protective equipment
- livestock weighing scales.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will articulate arguments confidently and effectively to evaluate the suitability of crop production systems, including annual, biennial and perennial cropping systems, giving detailed lines of reasoning and justifications for decisions made. Learners will demonstrate a broad insight into the factors affecting the crop system and show an effective level of skill for crop maintenance and management, based on ongoing and reflective observation and evaluation. Learners will give a detailed rationale covering the characteristics and purpose of crop production, including establishment, crop health and storage of crops. Learners will offer consistently valid, well-chosen examples that support their views. The evidence will show confident use of accurate agricultural terminology and principles throughout.

For Merit standard, learners will carefully consider the suitability of crop production systems, including annual, biennial and perennial cropping systems. They will analyse the parameters involved and the influence they have on production systems. Learners will use sound management principles for key aspects of preparation, planting, maintenance, harvesting and storage, and give a clear account of how these principles are applied to promote healthy crops, making suggestions for some remedial action. They will offer clear examples to support their views, providing a detailed investigation of the key characteristics of crops and the parameters that influence their production. Learners will be independent in their approach, showing that they have used research to extend their understanding to less familiar contexts. The evidence will show competent use of agricultural terminology.

For Pass standard, learners will investigate crop production characteristics in some detail and show understanding of annual, biennial and perennial crop production systems. Learners will consider characteristics of crops and give appropriate points on the key requirements for establishment and cultivation. Learners will safely carry out a range of tasks, covering the application of skills in planting, monitoring and harvesting for promoting healthy crops and applying appropriate storage practices. They will provide some appropriate examples to support their views, although these are likely to be undeveloped. There may be some minor irrelevancies in the use of appropriate agricultural terminology, with some omissions.

Learning aim B

For Distinction standard, learners will give a thorough and considered account of different livestock production systems and their impact on animal welfare. Their account will include breed, characteristics and system type, and show an understanding of the key requirements of the different production systems. Learners will show how they used effective techniques to confidently handle and restrain farm livestock species. They will carry out a convincing and in-depth investigation in order to justify the diets and feeding strategies that will show they can manage high standards of animal welfare that reflect industry standards and practice. Learners will demonstrate that they are able to apply practical skills in complex situations and that they are capable of performing safely while handling livestock, demonstrating a proficient use of handling and restraining equipment. Learners will give a detailed rationale to justify their practice, which can have an impact on animal welfare and, in turn, a negative effect on the production system. They will demonstrate breadth and depth of understanding of the purpose of animal husbandry in farming, using specific agricultural terminology accurately throughout.

For Merit standard, learners will show a broad understanding of different production systems and give competent and mostly relevant judgements as to their respective merits in relation to productivity and animal welfare. They will include detail of the animal breeds, characteristics and system types. Learners will show how they can use sound techniques to handle and restrain livestock, and comply with safety requirements. They will give a mostly coherent account of the provision of feed, water and nutrition to livestock; the account will include mostly relevant references to show that they can manage animal welfare. Learners will make mostly valid judgements when discussing the efficient management of animal nutrition, relating the impact of diets and feeding approaches to animal welfare. They will skilfully show that they are able to handle and restrain livestock in a range of situations while showing competent responsibility within the limits of their capabilities. They will make mostly logical judgements to show their understanding, using accurate agricultural terminology.

For Pass standard, learners will provide a descriptive but realistic account of production systems, making some connections between different types. They will give some detail in their investigation, although this may be unsupported in places; they will provide some appropriate examples to support their views, although these are likely to be undeveloped. Learners will carry out practical tasks in handling and restraining, demonstrating some initiative within the limits of their responsibility. Learners will complete tasks safely and adhere to health and safety requirements, with some exercise of risk management. Learners will show appropriate knowledge of the provision of feed in diets and the production system. They will show appropriate understanding of feed choice and feeding techniques for common livestock, with general explanations of how they have an impact on immediate welfare. Evidence of practice will be general, with some irrelevancies, and their description will use generic agricultural terminology but with omissions.

Learning aims C and D

In completing the assessment for learning aims C and D, learners are required to independently select, apply and demonstrate appropriate knowledge and skills relating to maintenance of infrastructure from *Unit 2: Estate Skills*, sector standards and practices from *Unit 7: Work Experience in the Land-based Sectors*, and operation and maintenance of farm equipment from *Unit 23: Land-based Machinery Operations*.

For Distinction standard, learners will produce a relevant and practicable farm production management plan that could be implemented with realistic resource availability. Plans will be based on in-depth monitoring and balanced evaluation of their own understanding, professionalism and skills application. Learners will make perceptive observations about how their own professional practice and applied farming practice has an impact on farming production outcomes. They will compare this with a thorough and detailed audit of farm production potential, with consideration of both internal and external constraints. Learners will apply inspection and monitoring with confidence, and broad and consistent understanding of crop maintenance and animal welfare within farming practice parameters. Monitoring of farm production will be assured and accurate, and will consider the impact of practice on productivity. Learners will consistently be looking for opportunities for development and focus on the maintenance of crops and animal welfare. This will inform a focused and reasoned plan that exploits the potential for their own development and that of the farm production. The plan will show logical aims and objectives, with a reasoned strategy for implementation covering all main areas, including resources, remedial actions for pests and disease, nutrition, welfare, waste, implementation, risk management and inspection. The plan will clearly identify and show work towards supporting broad aspects of regulation and licensing needs.

For Merit standard, learners will produce a sound farm production management plan that is informed by farm practice monitoring and some comparison of alternative production opportunities. Plans will be based on relevant and accurate monitoring of and reflection on their own understanding, professionalism and skills application. Learners will make competent observations of their own professional practice and applied farming practice, and how this impacts on general farming production outcomes. They will prepare a farm production plan with consideration of both internal and external constraints. Learners will apply inspection and monitoring competently and show broad understanding of crop maintenance and animal welfare within farming practice parameters. Learners will look for opportunities for development and focus on the maintenance of crops and animal welfare. This will inform a sound plan that explores the potential for their own development and that of farm production. The plan will show mostly logical aims and objectives, with a clear strategy for implementation covering the main areas, including resources, remedial actions for pests and disease, nutrition, welfare, waste, implementation, risk management and inspection. The plan will identify and show work towards supporting broad aspects of regulation and licensing needs.

For Pass standard, learners will maintain a level of assessment during practice of checking for the signs of deficiency in crops and livestock, this will inform their immediate practice, with some adaptation to support welfare. Learners will make appropriate observations of their own professional practice and applied farming practice, and how this impacts on general farming production outcomes. They will prepare a farm production plan with consideration of mostly internal constraints. Learners will make a coherent assessment of the suitability of the farm in order to suggest ideas for increasing productivity. This will inform a plan that describes some potential for their own development and that of the farm production. The plan will show appropriate aims and objectives, with a strategy for implementation covering the main areas, including resources, remedial actions for pests and disease, nutrition, welfare, waste, implementation, risk management and inspection. The plan will identify and show work towards supporting some aspects of regulation and licensing needs.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 2: Estate Skills
- Unit 7: Work Experience in the Land-based Sectors
- Unit 23: Land-based Machinery Operations.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses on crop or livestock production
- technical workshops involving staff from local land-based organisations
- support from farm staff as mentors
- work experience and feedback on performance
- access to livestock and working processes
- access to crop production working processes
- access to working equipment and facilities such as land-based machinery.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- safe working practices and procedures when working in land-based environments.

Unit 27: Identification, Planting and Care of Plants

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills needed to identify plants using botanical nomenclature, and their requirements for planting and initial aftercare.

Unit introduction

Plants shape our environments, bringing colour, beauty and wildlife, and thrive in both urban and rural locations. Planting occurs for many reasons, including the management of native woodland, the shaping of the landscape, the production of edible fruit, or simply as ornamental, stand-alone specimens. Being able to correctly identify plants is an essential part of becoming a horticulturalist, especially when selecting the appropriate plants for planting.

In this unit, you will learn the correct botanical nomenclature and terminology used when identifying plants as well as the individual characteristics that aid their identification. You will research a range of different plants suitable for a given area and select appropriate plants for planting, using your knowledge of their individual requirements. You will complete practical tasks in planting your chosen plants and providing initial aftercare so that they are established successfully. Understanding plant requirements and providing suitable surroundings and aftercare will mean that your plants will flourish.

This unit will give you the skills to identify, plant and care for plants. These skills are a huge advantage for progression to employment in roles such as a greenkeeper, gardener in the grounds of a public buildings, or an expert who recommends and sells plants in a garden centre. Alternatively, you may wish to progress to higher education, for example to a horticulture degree.

Learning aims

In this unit you will:

A Understand botanical nomenclature and terminology for the purpose of plant identification

B Explore factors affecting the selection of plants and their suitability for planting

C Undertake planting and initial aftercare of plants.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Understand botanical nomenclature and terminology for the purpose of plant identification	**A1** Terminology used in plant nomenclature **A2** Categorisation of plants **A3** Characteristics of plants for identification	A written report on the use of biological nomenclature and plant characteristics and how they are used for plant identification.
B Explore factors affecting the selection of plants and their suitability for planting	**B1** Selecting plants **B2** Factors affecting the suitability of plants	Research notes on the factors that affect the selection and suitability of plants for planting, using findings to select plants to plant in a given area. A portfolio of evidence showing how plants are selected, planting activities and initial aftercare to ensure plants establish successfully.
C Undertake planting and initial aftercare of plants	**C1** Preparation for planting **C2** Planting methods **C3** Providing initial aftercare	

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Content

Learning aim A: Understand botanical nomenclature and terminology for the purpose of plant identification

Naming conventions and taxonomic categories used to identify plants based on their features, and the importance of using the correct terminology.

A1 Terminology used in plant nomenclature

- Plant classification order:
  - kingdom
  - phyla, including pteridophytes, bryophytes, gymnosperms and angiosperms
  - class, including monocotyledons and dicotyledons
  - family
  - genus
  - species
  - sub-species, variety, cultivar, hybrid.
- Importance of botanical names:
  - problems that occur using common plant names, including using the native tongue, regional differences, common names being similar but not belonging to the same genus
  - reclassification and why this happens, including international codes and characteristics of a plant
  - binominal system for plant naming.
- Correct format for writing plant names:
  - correct use of capital letters, lower-case letters, single quotation marks
  - correct use of symbols and abbreviations
  - correct use of descriptive names to aid identification, e.g. variegata, pendula, grandiflora.

A2 Categorisation of plants

Definition, categorisation and identification of plants from native and non-native species:

- annuals, biennials and ephemerals
- hardy perennials
- herbaceous perennials
- woody; trees and shrubs
- alpines
- grasses
- climbing plants
- weeds
- aquatic plants
- tropical/temperate plants
- exterior, interior, ornamental.

A3 Characteristics of plants for identification

Methods used to identify plants, using plant features and characteristics.

- Morphological features used in the identification of plants:
  - flowers, including bud, calyx, corolla, androecium, gynoecium, shape, colour arrangement
  - foliage, including stem, lenticels, nodes, internodes
  - venation, including primary veins, secondary veins, reticulated and parallel, simple and compound
  - leaf types, including cordate, ovate, lanceolate, linear, oblong, palmate, pinnate, trifoliate, lobed
  - leaf colour
  - leaf arrangement, including alternate, spiral, opposite and whorled, leaf bud, petiolate and sessile
  - margins and modifications
  - succulent fruits, including berries, fruits and drupes
  - seeds
  - seasonal features, including stems, foliage, flowers, seeds, fruits.
- Identification methods and tools:
  - tactile features, including smooth, soft, spiked, rough, spongy
  - smell, including fragrant flowers, foliage, sap
  - visual observations, including growth habit, height, spread
  - form, including oval, columnar, rounded, pyramidal, weeping, irregular, vase
  - illustrated textbooks, nursery catalogues, brochures and labels
  - technology, including internet research, smartphone apps
  - identification keys, including flow chart, dichotomous key.
- Sources of information and standards for classification, e.g. botanical gardens, environmental organisations.

Learning aim B: Explore factors affecting the selection of plants and their suitability for planting

B1 Selecting plants

Plant requirements:

- preferred soil type, including clay, sand, silt, loam, pH
- nutrient requirements, including primary/macronutrients, secondary nutrients and trace elements for growth, vigour, establishment, flowering and fruiting
- aspect, including light and shade tolerance, space, frost and sun pockets, protection, topography, air quality
- support needs, including stakes, frames, wall, fence, trellis
- planting stock type, including bare root, root balled, containerised, seedlings, plugs and transplants
- specific requirements, such as protection and support type for individual plants, including Delphinium, Dahlia, Begonia, Cordyline, Lonicera, Wisteria, Cortaderia, Agave and Musa.

B2 Factors affecting the suitability of plants

- Plant growth and habit:
  - size of plant at planting, growth speed, root spread, size and shape and appropriateness for given purpose, including prostrate, fastigiate, columnar, weeping, broad, round, irregular.
- Surroundings that affect plant selection:
  - environmental factors, including buildings and structures, established plants, hard and soft landscaping, overhead and underground services, climate and microclimate, traffic, exposure, drainage, uneven ground, preferred habitat, space
  - access areas, including public, vehicles, maintenance, footpaths, rights of way, falling leaves, fruit, overhanging branches, roots
  - aesthetic value, grouping and combinations, including shape, size, colour, texture, scent
  - intended purpose of area, including formal and informal, temporary and permanent, interior and exterior; themed, e.g. sensory, ecological to add wildlife value, recreational, leisure
  - soil structure; texture; pH; drainage; depth; nutrient value, including impact on anchorage and support systems.

Learning aim C: Undertake planting and initial aftercare of plants

Considerations when preparing to plant, planting and providing initial aftercare for plants.

C1 Preparation for planting

- Assessing risk and working safely:
  - identification of hazards and risks of the work area (related to tools, equipment and people) and how these can be minimised, including essential personal protective equipment (PPE)
  - laws/legislation for environmental protection, wildlife protection, health and safety at work, safe use of chemicals
  - methods for working safely and minimising damage to working areas.
- Use and application of correct tools, materials and equipment to prepare ground for planting:
  - tools, including spade, rake, hoe, trowel, hand fork, wheelbarrow
  - materials, including stakes, ties, guards, soil conditioners, organic matter, fertiliser base dressing
  - machinery, including cultivator, rotavator.
- Ground preparation:
  - cultivation by hand or machine, including correct depth, consolidation, level, addition of soil conditioners, ameliorants, fertilisers, anti-desiccants, mycorrhizal use, as appropriate to area and location
  - removal of plant debris, weeds, organic and inorganic waste before planting and correct disposal.

C2 Planting methods

Activities carried out to ensure optimum condition for planting and successful establishment.

- Use and application of correct tools and equipment for planting:
  - tools, including spade, rake, hoe, trowel, hand fork, secateurs, wheelbarrow.
- Plant preparation, including watering, pruning, removal of weeds, deadheads and dead leaves to ensure plants look good and are in optimum condition for planting for successful establishment.
- Planting:
  - safe working practices to minimise damage to working area and self
  - ensuring planting hole is sufficient and correct depth achieved
  - handling plants without causing damage
  - backfilling
  - safe disposal of waste, including organic and inorganic
  - safe removal of tools and equipment.

C3 Providing initial aftercare

Methods, equipment and materials used for successful establishment and growth.

- Plant protection, including support, e.g. stakes, ties, frames for protection from animals, people and weather.
- Initial aftercare to ensure successful establishment of plants, including feeding, watering, pruning, mulching with organic and inorganic materials; disposal of waste, including organic and inorganic, importance of recycling materials where possible.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand botanical nomenclature and terminology for the purpose of plant identification		
A.P1 Explain how botanical nomenclature and terminology are used to identify plants, using outline examples. **A.P2** Explain plant classification and different characteristics that aid identification, using outline examples.	**A.M1** Analyse how botanical nomenclature and characteristics are used to aid plant identification, using relevant examples.	**A.D1** Justify how botanical nomenclature and characteristics are used to aid plant identification, using detailed and accurate examples.
Learning aim B: Explore factors affecting the selection of plants and their suitability for planting		
B.P3 Explain the considerations that have influenced own selection of plants for use in a given area. **B.P4** Explain why the selected plants are suitable for a given area.	**B.M2** Analyse the factors that have influenced own selection of plants, giving detailed examples of why they are suitable for a given area.	**B.D2** Evaluate own selection of plants based on factors that affect selection and suitability for a given area.
Learning aim C: Undertake planting and initial aftercare of plants		
C.P5 Demonstrate safe working practices when carrying out ground preparation, planting and aftercare to establish new plants. **C.P6** Explain methods used to carry out planting and initial aftercare of plants.	**C.M3** Demonstrate efficiency when preparing, planting and providing appropriate aftercare to establish new plants. **C.M4** Analyse the impact of own methods used to carry out planting and aftercare.	**C.D3** Demonstrate the effective preparation, planting and aftercare in the establishment of new plants, with a detailed analysis of the impact of the methods used.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, C.M4, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of plants to study, from young to mature (this can be off site)
- an area to plant and establish new plants
- appropriate, well-maintained tools, equipment and materials for preparing ground, planting and providing initial aftercare to plants
- suitable PPE.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will provide a thorough and detailed account of the effectiveness of biological nomenclature and physical plant characteristics when identifying plants. They will show depth of understanding by making detailed links between their use and plant identification, using well-selected, accurate examples of how this leads to positive identification. Learners will provide detailed reasoning as to the limitations of using descriptive biological nomenclature and characteristics to identify plants, using well-selected examples of negative identification.

Learners will consider identification methods and tools thoroughly, recommending those that lead to positive identification.

For Merit standard, learners will examine the effectiveness of biological nomenclature and characteristics when identifying plants. They will demonstrate their understanding by making clear links between their use and plant identification, using appropriate examples of how this leads to positive identification. Learners will demonstrate awareness of the limitations of these methods to identify plants, and support this through the use of examples and an explanation of some of the issues.

Learners will demonstrate a clear understanding of identification methods and tools, and provide clear reasoning as to the link between the methods and positive identification.

For Pass standard, learners will demonstrate a clear understanding of the approach used in botanical nomenclature and the methods used to obtain a positive identification of plants using physical characteristics. Learners will demonstrate some awareness that there are limitations to their use.

Learners will provide details of a number of identification methods and tools, and the main reasons they may be selected for use.

Learning aims B and C

For the assessment, learners should be provided with a given area to carry out the selection, preparation, planting and aftercare of plants.

For Distinction standard, learners will demonstrate clear and detailed reasoning for their plant selection through a thorough examination of the given planting area, considering all relevant aspects that may affect successful establishment. This will include full details of the plant requirements for successful growth, meticulously linked to the site conditions. Learners will consider their choices carefully, and fully justify their selection in relation to factors affecting suitability.

Learners will carry out planting and initial aftercare that is effective in supporting the successful establishment of their chosen plants. Learners will evidence clear ways to minimise risks and fully demonstrate competent safe working practices throughout. They will select correct tools, materials and equipment, using them safely and to industry standard. They will draw on knowledge from their learning to reflect on the decisions they made when planting and carrying out practical tasks. Efficient care of the plants will be provided throughout the planting and aftercare processes.

Learners will show a comprehensive understanding of plant requirements before planting, during planting and when providing initial aftercare to support the successful establishment of plants.

Learners will review the methods they used for planting and initial aftercare to thoroughly explore where they were successful and where methods could be improved or carried out differently.

For Merit standard, learners will provide evidence to show that they have researched different plants and plant types to select plants for planting that clearly match the site conditions and the likelihood of successful establishment. Learners will review their selection of plants, presenting well-documented evidence and making reasoned recommendations for their selection, providing clear links between the features of the given planting site and the selected plants.

Learners will carry out planting, showing they have optimised the given area through the preparation of the site and plants, planting with skill, and by demonstrating efficiency in the time taken, the resources used and the minimal disruption to the plants during the planting process. Learners will draw on their knowledge to consider ground conditions and prepare the area appropriately. They will assess the hazards and risks involved in carrying out the practical tasks and use the required tools, materials and equipment safely and competently.

Learners will show detailed knowledge of individual plant requirements in order to provide initial aftercare that helps to support successful establishment, for example providing plant supports for weak-stemmed plants.

Learners will reflect on the methods they used and make clear connections to their impact on the successful establishment of plants.

For Pass standard, learners will provide details of the features and characteristics of a given area and research a range of suitable plants for the area, demonstrating an understanding of different plant types, requirements and any limiting factors of the area to be planted. Learners will select a range of plants from those researched, making links between site characteristics and plant requirements.

Learners will work safely, with an awareness of the risks and potential issues arising when preparing the ground for planting, during the planting process, and when providing initial aftercare. Learners will use appropriate methods, tools and equipment to prepare and plant their selected plants, leaving the area clean and tidy on completion. Learners will provide basic aftercare for plants, showing consideration for time of year and the group of plants, for example applying mulch over the area planted in early spring or late autumn. On completion of the tasks, learners will safely remove and store tools, materials and equipment, disposing of waste materials appropriately.

Learners will provide reasons for their selected methods of planting and aftercare, demonstrating some understanding of the impact these methods have on the successful establishment of plants.

Links to other units

This unit links to:

- Unit 2: Estate Skills
- Unit 7: Work Experience in the Land-based Sectors
- Unit 29: Plant Propagation Activities.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research and analysis skills through investigation of botanical nomenclature and its uses
- evaluative and developmental skills
- practical application when caring for plants
- safe working practices and procedures when working in land-based environments.

Unit 28: Routine Plant Management

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners explore and apply skills to cultivate, grow and maintain a selection of plants.

Unit introduction

The routine management of plants is essential to support their healthy growth and development and crucial to maintaining plant husbandry – from cultivation through to successful establishment.

In this unit, you will draw on your knowledge and skills developed across the programme to cultivate, grow and maintain a selection of plants, applying your skills and understanding of their planting and growing requirements. You will learn and apply plant husbandry skills to establish and maintain growth, keeping accurate records of their progress. To complete the assessment task in this unit, you will need to draw on your learning from across the programme.

This unit will be helpful if you want to progress to employment in the land-based industries that are involved with plant husbandry in roles such as gardener, landscape and garden designers, or working in a garden centre. It is also suitable if you want to seek self-employment in the industry. This unit will enable you to progress to higher-education courses such as a degree in plant or crop science.

Learning aims

In this unit you will:

A Understand planting and growing requirements to support the healthy growth of plants

B Apply cultivation methods for plant husbandry and growth

C Carry out routine husbandry tasks to maintain the health and growth of plants.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Understand planting and growing requirements to support the healthy growth of plants	**A1** Establishing plants **A2** Requirements for growth	A presentation/report on the establishment techniques and growth requirements for plants.
B Apply cultivation methods for plant husbandry and growth	**B1** Cultivation methods **B2** Planting systems	An evaluative report on the effectiveness of husbandry techniques used in the care of plants, supported by evidence of practical plant husbandry activities, including diary entries, photographs, and witness statements.
C Carry out routine husbandry tasks to maintain the health and growth of plants	**C1** Working safely **C2** Feeding and watering requirements **C3** Temperature, ventilation and plant protection	

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Content

Learning aim A: Understand planting and growing requirements to support the healthy growth of plants

A1 Establishing plants

Factors to consider when selecting and establishing plants, including:

- types of plant used in common planting systems, to include annual, biennial and perennial, grasses for greenkeepers, and ornamental grasses
- variety and choice, genus and species, cultivars, resistance to weather, disease and drought, yield, end use, suppliers' recommended varieties
- requirements of the plant, e.g. space, light and orientation to maintain healthy growth and development
- growing conditions and mediums, to include tilth, texture, soil, compost, hydroponics, alternative mediums
- climatic requirements, including variations in rainfall, temperature and humidity; exposure to winds, frost and sunlight
- plant health, including health indicators, e.g. foliage colour, stem strength, growth pattern
- establishment needs of plants, including bulbs, planting rate, plant spacing, seed spacing, transplanting and pricking out
- target plant populations, planting depth.

A2 Requirements for growth

Importance and effectiveness of methods used to promote plant growth at different growth stages.

- Changes in requirements for healthy growth at different growth phases, including germination, emergence, elongation, flowering, fruit and seed production.
- Environmental conditions needed throughout the growing period, to include temperature and the effects of temperature change; space and lighting levels needed to support growth; moisture and oxygen levels that promote good growth; soil type; aspect.
- Support mechanisms for growing plants, e.g. trellis, canes, stakes.

Learning aim B: Apply cultivation methods for plant husbandry and growth

B1 Cultivation methods

- Methods of cultivation, to include primary, secondary, deep cultivation, double digging, rototilling, non-inversion, consolidation.
- Optimum timing of cultivation and its benefits – changes throughout year in weather and plant life/seasons, natural weathering.
- Benefits of cultivating soil, to include moisture conservation, soil structure, soil damage, soil improvement.
- Cultivation equipment, to include hand tools, e.g. spade, fork, trowel, hoe; powered machinery, e.g. rototiller, roller.
- Cultivating settings, width of machine, depth of cultivation, to include deep and shallow working depths.

B2 Planting systems

The use and effectiveness of planting systems, and factors affecting their selection in different situations.

- Rotations and choice of plants used within a sequence.
- Monoculture and intercropping.
- Planting styles for different systems, e.g. informal, border, cottage garden, prairie garden.

Learning aim C: Carry out routine husbandry tasks to maintain the health and growth of plants

Selection and use of practical husbandry techniques to optimise plant health.

C1 Working safely

- Responsibilities for personal safety under the legislation/law for health and safety at work.
- Use of personal protective equipment (PPE), to include boots, coveralls, gloves, face shield, ear defenders.
- Care required when working with plants, including potentially harmful plants, e.g. spines, stings; safe lifting techniques for carrying heavy items, bending to work at low levels, working with chemicals.

C2 Feeding and watering requirements

- Watering routine, amount and frequency, impact on plant health, signs of distress.
- Application methods used in watering plants, e.g. watering can, drip system, irrigation.
- Sources of nutrition, to include artificial, natural, feed in water.
- Role of nutrition elements, to include major nutrients (nitrogen (N), phosphorus (P), potassium (K)), minor nutrients (calcium (Ca), iron (Fe), magnesium (Mg), sulfur (S)), trace elements (copper (Cu), zinc (Zn), molybdenum (Mo), boron (B)).
- Elements from soil, water and the atmosphere, carbon (C), hydrogen (H), oxygen (O).
- Macronutrients: nitrogen, phosphorus, potassium, calcium, magnesium, sulfur.
- Micronutrients: boron, chlorine (Cl), copper, iron, manganese (Mn), molybdenum, zinc, nickel (Ni).
- Timing of nutrient application, to include early growth, mid growth, flowering and fruit production.

C3 Temperature, ventilation and plant protection

Correct selection and control of factors that optimise growing conditions for good plant health and growth.

- Sources of ventilation, to include artificial, natural, when ventilation is needed and its benefits to the plant.
- Temperature recording, to include the effects of high/low temperature, ambient temperature, relative humidity.
- Monitor and record temperatures and level of ventilation given to plants.

- Protection against adverse weather, to include frost, temperature variation and fluctuation, problems caused by the adverse weather, growth habits.
- Removal of weeds; chemicals, including herbicides and selective herbicides; cultural methods.
- Equipment used in protecting the plant, to include fleeces, nets, canes, stakes, string, ties and cloches.
- Importance of monitoring and recording the plant health and husbandry methods applied, and actions to take if any problems occur, including remedial action for plant protection problems such as an increase or decrease in ventilation, fluctuations in temperature.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand planting and growing requirements to support the healthy growth of plants		**A.D1** Analyse the requirements for the establishment and growth of plants, and show how this has a direct effect on successful plant husbandry.
A.P1 Explain the basic requirements to support the healthy growth of plants. **A.P2** Explain the different factors that can affect the establishment and growth of plants.	**A.M1** Assess the requirements for planting and growing healthy plants, and the factors that affect their establishment and growth.	
Learning aim B: Apply cultivation methods for plant husbandry and growth		**B.D2** Evaluate the systems used in the cultivation and planting of different species of plant.
B.P3 Explain the different planting systems used to promote good plant husbandry. **B.P4** Select and use cultivation methods to prepare for plant growth.	**B.M2** Assess different planting and cultivation systems that ensure good health in plants. **B.M3** Select and use appropriate cultivation and planting methods to prepare for plant growth.	
Learning aim C: Carry out routine husbandry tasks to maintain the health and growth of plants		**C.D3** Record and review the methods used for plant protection, and make recommendations for improvement to promote higher standards of care.
C.P5 Demonstrate the provision of basic plant husbandry and protection in line with health and safety standards. **C.P6** Produce outline records on the health and growth of plants.	**C.M4** Demonstrate the provision of routine plant husbandry and protection for different plant species, keeping detailed records of their health and growth.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, B.M3, C.M4, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a wide range of annual, biennial and perennial plants
- a suitable area for cultivating and establishing plants
- a range of tools/equipment to be used for the cultivation and establishing of plants.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will demonstrate an in-depth understanding of the planting and growing requirements needed to support the healthy growth of plants. This will include examples from a broad range of different types of plant. They will make clear and relevant links between the factors affecting the growth of plants and successful plant husbandry. Learners' work will be structured, making valid and well-supported judgements, and using clear and accurate terminology.

For Merit standard, learners will demonstrate a detailed understanding of the requirements for plant growth, using examples from a range of different types of plant. They will explain most of the factors that affect their establishment and growth. They will also explain establishment techniques and growth requirements, and how the techniques affect plant growth commercially. Learners will produce clearly written evidence supported by mainly relevant examples, and the work will contain reference to appropriate terminology.

For Pass standard, learners will give an explanation of the requirements needed to support the healthy growth and development of plants. They will explain, but may have limited knowledge of, the different establishment techniques and the growth requirements needed for plants. There may be some minor inaccuracies and some terminology may be omitted.

Learning aims B and C

For Distinction standard, learners will fully consider different types of cultivation and the impact this can have on planting different species. They will carry out their chosen cultivation activities confidently while preparing media for planting. They will also give a clear rationale regarding the requirements of plant food and water and ventilation and temperature.

They will demonstrate that they can select and work with a range of irrigation systems and plant treatments appropriate for different plants and species. They will reflect on their progress and make recommendations, where appropriate, of ways to further improve the standard of care of the plants.

For Merit standard, learners will give a clear assessment of cultivation methods and they will carry out cultivation in a safe and appropriate manner while preparing mediums for planting.

They will demonstrate that they can work with more complex irrigation systems and provide plant protection and apply treatments for a range of plants. Learners will give due care and consideration to the health and safety requirements for themselves and others.

For Pass standard, Learners will provide explanations of some of the cultivation and planting systems that can be used to ensure good plant husbandry and will select and use some appropriate techniques when preparing media for planting.

Learners will demonstrate that they can deliver feed and water through a simple irrigation system and provide some aspects of plant protection and treatments. Learners will give due care and consideration to the health and safety requirements of themselves and others.

Links to other units

This unit links to:

- Unit 27: Identification, Planting and Care of Plants
- Unit 29: Plant Propagation Activities.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- reflective practices when considering cultivation processes
- practical application when reflecting on different planting systems
- safe working practices and procedures when growing plants.

Unit 29: Plant Propagation Activities

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills to plan for the propagation and establishment of a range of plants, using a wide range of seed and vegetative propagation techniques.

Unit introduction

Horticulturalists often need to plan and propagate plants for a range of different purposes, for example conservation of the natural world and rare species, for crop production, for the supply of decorative plants for amenity areas and green spaces.

In this unit, you will draw on the skills and knowledge you have developed across the programme to plan for and propagate a range of plants. You will put together propagation schedules, planning the type of structure, equipment and facilities needed for a range of plants. You will then apply seed and vegetative propagation techniques for their specific requirements and provide aftercare for your propagated plants so that they are established successfully. To complete the assessment task in this unit, you will need to draw on your learning from across the programme.

This unit will help you to develop the skills for a number of roles in the horticulture sector, such as gardener, nursery worker, propagation scientist, plant breeder. You could also progress to an advanced apprenticeship or to a higher-education course in horticulture.

Learning aims

In this unit you will:

A Explore the factors affecting successful plant propagation to produce propagation schedules

B Undertake seed and vegetative propagation to meet production requirements

C Undertake the aftercare of propagated plants to achieve successful establishment.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore the factors affecting successful plant propagation to produce propagation schedules	**A1** Environmental conditions necessary for propagation **A2** Physical structures for managing the propagation environment **A3** Planning schedules for targeted plants	A report on the environmental conditions and facilities needed to enable the production of propagation schedules for two named plants. Propagation schedules.
B Undertake seed and vegetative propagation to meet production requirements	**B1** Collection and preparation of propagation material **B2** Preparing growing media for propagation **B3** Establishing propagation material in the propagation environment	Evidence includes: • photographic evidence of propagation and aftercare tasks carried out covering both seed and vegetative methods, supported by a log detailing the techniques used. • photographic evidence of the initial aftercare, ongoing plant care supported by learners' monitoring records.
C Undertake the aftercare of propagated plants to achieve successful establishment	**C1** Initial aftercare **C2** Ongoing plant care and monitoring	

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Content

Learning aim A: Explore the factors affecting successful plant propagation to produce propagation schedules

A1 Environmental conditions necessary for propagation

Environmental manipulation to enhance the propagation of propagules (cuttings, seeds).

- Environmental factors (microclimatic conditions) in the immediate vicinity of the propagule during propagation:
  - relative humidity, to include intermittent mist and turgor for growth processes
  - temperature, to include both aerial and base heat
  - gases and gas exchange, including oxygen, carbon dioxide, ethylene
  - light, including photoperiod, light quality.
- Factors influenced by the soil or propagation medium (edaphic factors):
  - propagation medium or soil
  - mineral nutrition, e.g. fertigation, controlled-release fertilisers
  - water.
- Biotic factors, to include the interaction of propagules with other organisms such as beneficial bacteria, mycorrhizal fungi, pathogens, insect pests, weeds.

A2 Physical structures for managing the propagation environment

The types of structure available and their purpose in the land-based sector.

- Structures, e.g. greenhouses, germination rooms, propagation frames.
- Equipment, e.g. mist and fog units, heated bins, hot-pipe grafting facilities.
- Covering materials, e.g. glass, polyethylene, polycarbonate.
- Construction materials, e.g. aluminium, galvanised iron or steel, wood.

A3 Planning schedules for targeted plants

Planning, in order to coordinate time, resources, labour, and space to produce healthy plants on time.

- Planning components:
  - available space
  - crop layout based on the number of plants required
  - schedule of propagule collection and processing, of propagule treatment, of propagule establishment
  - growing schedule to meet target date for delivery of finished plants.
- Propagation protocols to coordinate the production of all crops being grown simultaneously:
  - species name and ecotype
  - duration required to grow to targeted plant specification
  - target specifications, e.g. height, root system, stem diameter
  - propagule collection, e.g. 'true to type', time of year
  - propagule processing, e.g. cleaning techniques of seed, scarification
  - approximate crop timing, e.g. sowing to transplanting
  - growing area required, e.g. heated bench, seedbed, use of low tunnels
  - sowing and cutting process
  - approximate crop timing, e.g. sowing to transplanting
  - growing, to include feeding, growth regulation, temperature and pH control, pack or pot size, planting out, common diseases and pests.

Learning aim B: Undertake seed and vegetative propagation to meet production requirements

B1 Collection and preparation of propagation material

- Health and safety procedures when working outside and in propagation facilities:
  - personal protective equipment (PPE)
  - preparation and use of risk assessment
  - correct selection, use, transport and carrying of tools and equipment for carrying out tasks
  - safe working procedures to ensure protection of self and others.
- Correct use and maintenance of tools and equipment, including cleaning and storage.
- Collection and preparation of plant material for propagation:
  - seed, e.g. dehiscent, indehiscent
  - vegetative material, to include perennials, e.g. herbaceous, hardy and woody trees and shrubs.
- Practical management techniques, e.g. handling, pruning, cutting.
- Processing, e.g. soaking, maceration, drying.
- Overcoming seed dormancy, e.g. scarification, stratification.
- Storage, e.g. length of storage, temperature regimes, packaging.
- Management of stock plants to promote juvenile or adult material, e.g. routine and formative pruning techniques.
- Recognition of the most appropriate plant material to select, to include 'true to name, type and form', of appropriate size, free from environmental and physiological disorders, pest-, disease- and weed-free.
- Information for recording purposes in propagation logs or crop records, e.g. information on provenance, treatments, date of sowing.
- Plant health regulations, e.g. plant passports, phytosanitary certificates, biosecurity.

B2 Preparing growing media for propagation

- Preparation of raised seedbeds, to include aeration and drainage; amelioration; enhancement by added mycorrhizae or similar, to include consolidation, levelling and pest protection.
- Composts for seeds, seedling and transplants:
  - recognition of compost formulas, to include loam-based and loamless seed and cutting mixes
  - preparation by hand or mechanical means
  - aggregate range used, such as sterilised loam, peat, coir, rock wool, bark, perlite, vermiculite, horticultural sand or grit.
- Seed propagation:
  - sowing techniques, to include in situ; use of containers and nursery beds; manual, e.g. placement; broadcast or mechanical sowing methods, e.g. seedling machines
  - positive effects moisture, oxygen levels, temperature, seed viability, provenance and light on germination rates
  - methods used to enhance the environmental conditions required for optimum germination, e.g. use of germination cabinets, soil cultivation techniques.

- Vegetative propagation:
  - propagation techniques, to include division, cuttings; softwood, semi-ripe, hardwood, root, leaf or leaf section and leaf bud, layering and grafting, e.g. apical, side, 'T' chip
  - micropropagation, to include stages of propagation through to the weaning stage
  - recognition of natural vegetative means, to include bulbs, corms, stolons, stem tubers, plantlets and foliar embryos
  - methods used to enhance the environmental conditions required for optimum root and/or shoot production, to include growth regulators, wounding, mist units, closed cases, low polythene tunnels, covers, growth rooms and heated benches, closed floors.

B3 Establishing propagation material in the propagation environment

- Structures, e.g. tunnels, germination cabinets and rooms, glasshouses, outdoor cutting beds.
- Equipment, e.g. mist and fog units, heated bins, beds and benches, hot-pipe grafting facilities, lined-out rootstock beds for budding and grafting.
- Covering materials, e.g. glass, polyethylene, net.
- Establishment of plants, to include:
  - the control of moisture, e.g. systems, humidity levels, ventilation
  - light levels, shade
  - hygiene
  - pests, diseases, disorders and weeds
  - germination and rooting
  - completion of records, e.g. propagation log, crop record.

Learning aim C: Undertake the aftercare of propagated plants to achieve successful establishment

C1 Initial aftercare

Carry out aftercare to achieve successful establishment.

- Plant protection, including support, e.g. stakes, ties, frames for protection from animals, people and weather.
- Initial aftercare to ensure successful establishment, to include feeding, watering, pruning, disposal of organic and inorganic waste, recycling materials.
- Recognition of the positive effect weaning plants has on the quality of the plants produced.

C2 Ongoing plant care and monitoring

- Factors to consider in aftercare and monitoring of plants and the propagation environment:
  - watering
  - control of moisture, e.g. humidity levels, ventilation
  - controls to include aerial and base temperature, light and shade, hygiene, gaseous control
  - removal of damaged, dying and decaying material
  - prevention and control of pests, diseases, weeds and disorders
  - germination and rooting.

- Practical aftercare management techniques, to include trimming and pinching back, separation, thinning, pricking out, transplanting, potting up.
- Development of plants for sale or use in the landscape, selection of containers, growing media, fertiliser, irrigation methods, support, potting depth, trimming; stand down and set out stock on benching or ground as necessary, outdoors, under protection, straight lines, spacing.
- Completion of appropriate records, e.g. propagation record, growing-on log, crop records to enable reviews.

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Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Explore the factors affecting successful plant propagation to produce propagation schedules</td><td rowspan="2">A.D1 Analyse the factors that affect successful propagation, producing comprehensive propagation schedules for the seed and vegetative propagation of specified plants.</td></tr>
<tr><td>A.P1 Explain the environmental conditions and the facilities needed for seed and vegetative propagation of plants.
A.P2 Produce simple propagation schedules for the seed and vegetative propagation of specified plants.</td><td>A.M1 Assess the factors that affect successful propagation, producing detailed propagation schedules for the seed and vegetative propagation of specified plants.</td></tr>
<tr><td colspan="2">Learning aim B: Undertake seed and vegetative propagation to meet production requirements</td><td rowspan="2">B.D2 Carry out seed and vegetative propagation and establishment activities effectively, demonstrating a comprehensive understanding of the techniques required for the specified plants.</td></tr>
<tr><td>B.P3 Carry out basic seed and vegetative preparation and propagation activities for specified plants.
B.P4 Carry out simple establishment of propagation material for propagated plants.</td><td>B.M2 Carry out seed and vegetative propagation and establishment activities efficiently, working to the required timelines and using appropriate techniques.</td></tr>
<tr><td colspan="2">Learning aim C: Undertake the aftercare of propagated plants to achieve successful establishment</td><td rowspan="2">C.D3 Carry out effective plant maintenance and aftercare for specified propagated plants, evaluating approaches used in the weaning process.</td></tr>
<tr><td>C.P5 Carry out plant maintenance and aftercare activities competently for specified propagated plants.
C.P6 Explain the approaches used in the weaning process and their impact on plant quality.</td><td>C.M3 Carry out plant maintenance and aftercare activities efficiently for specified propagated plants.
C.M4 Assess the approaches used in the weaning process and their impact on plant quality.</td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, C.M4, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of common materials and specialist hand tools, including power tools and testing equipment
- suitable PPE
- access to a suitable range of environmental-control equipment and systems
- regular access to a range of physical structures and open ground to carry out propagation and growing tasks
- regular access to a range of plant material for propagation and maintenance.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give a thorough and detailed account of the environmental conditions and facilities needed for the successful propagation and establishment of plants, using both seed and vegetative methods. Learners will support their account with well-considered examples. They will demonstrate depth and breadth of knowledge and understanding, drawn from across the learning aims, to provide clear and logical reasoning as to how physical structures affect the choice of propagation method.

Learners will produce comprehensive propagation schedules for two seed and two vegetatively propagated plants. The schedules will include detailed and accurate timescales, detailed reasoning for the resources required, and contingency planning to ensure the successful propagation and establishment of the plants. It will be clear that learners have a depth of understanding of the appropriate preparation and propagation techniques to be used to meet the requirements of the specified plants. Learners will include possible risks and how these can be minimised. They will use accurate technical terminology confidently and consistently.

For Merit standard, learners will give a detailed account of the environmental conditions and facilities needed for the successful propagation and establishment of plants, using both seed and vegetative methods. Learners will support their account with relevant examples. They will show an understanding of how physical structures affect the choice of propagation method.

Learners will produce propagation schedules for two seed and two vegetatively propagated plants, which cover, in detail, resources required, timescales and the preparation and propagation techniques to be used. The schedules will show a clear relationship between the methods selected and intended plant use. Learners will include some details on how to manage risk.

It will be clear from the schedules that learners have an understanding of all stages leading to propagation, and they will have a good knowledge of the connections between temperature regimes, growing media, growth regulation, pack or pot size, and common diseases and pests. Learners will use mostly accurate technical terminology.

For Pass standard, learners will demonstrate a realistic awareness of the environmental conditions and facilities needed for the successful propagation and establishment of plants, using both seed and vegetative methods. They will demonstrate some understanding of how the environment can be manipulated depending on physical facilities, including greenhouses, cladding materials such as glass, and construction materials such as aluminium.

Learners will produce simple propagation schedules to support the development of two seed and two vegetatively propagated plants. They will plan the key activities with a timeline and some resources but will not include all detail. Learners will include some reference to risks.

From the schedules it will be clear that learners have a basic knowledge of the connections between temperature regimes, growing media, container size, timings and potential pests and diseases. Learners will use some technical terminology but there may be some inconsistencies.

Learning aims B and C

For Distinction standard, learners will carry out propagation, establishment and aftercare that is effective in supporting the development of the specified plants. They will evidence clear ways to minimise risks and fully demonstrate competent safe working practices throughout. Learners will select correct tools, materials and equipment, using them safely and to a high standard. They will draw on knowledge from their learning to reflect on the decisions they made when carrying out practical tasks. Learners will demonstrate an in-depth understanding of the plants they are working with and the plants' requirements before propagation, during propagation and when providing aftercare, and the positive effect weaning plants has on the quality of the plants produced.

Learners will review the techniques they used for propagation and aftercare to explore thoroughly where they were successful and where techniques could be improved or carried out differently. This will show a depth of understanding of the impact tasks have on structures, facilities, the management of integrated pest management, and intended use, such as for hedging, specimen trees, successional bedding or mixed borders.

For Merit standard, learners will carry out propagation, establishment and aftercare, showing they have optimised the given area through their preparation and by demonstrating efficiency in the time taken, the resources used, and the minimal disruption during the processes. They will assess the hazards and risks involved in carrying out the practical tasks and use the required tools, materials and equipment safely and competently.

Learners will show detailed knowledge of individual plant requirements in order to provide aftercare that helps to support successful establishment. They will demonstrate an understanding of the weaning process and how it impacts on plant quality. Learners will reflect on the methods they used and make clear connections to their impact on the successful establishment of plants

For Pass standard, learners will carry out propagation, establishment and aftercare, showing they can work safely, with an awareness of the potential risks and ensuring others are not in danger from their activities. Learners will use required materials, tools and equipment, leaving the area clean and tidy on completion and disposing of waste materials appropriately. They will show an awareness of the need to provide suitable environmental controls through the use of appropriate structures and facilities. Learners will show a realistic awareness of the weaning process, making some links with its impacts on plant quality. They will provide reasons for their selected methods of planting and aftercare, demonstrating some understanding of the impact these methods have on the successful establishment of plants.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 7: Work Experience in the Land-based Sectors
- Unit 27: Identification, Planting and Care of Plants.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- reflective practices when considering propagation processes
- practical application when reflecting on different planting media
- safe working practices and procedures when growing plants.

Unit 30: Tree and Shrub Pruning and Maintenance

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop skills in pruning and maintaining trees and shrubs, assessing them for potential failure and suggesting remedial solutions.

Unit introduction

Trees and shrubs are a much loved and standard part of the landscape. It is vital, therefore, that they are managed properly to maintain or enhance their aesthetic value, guarantee or increase their longevity, and ensure that they do not pose any risks to the people or property around them.

In this unit, you will learn how pruning may be used to manage the growth and development of a range of trees and shrubs, and how pruning techniques will vary according to plant species, age, situation and intended purpose. You will learn the techniques and procedures used to prune trees and shrubs, and then carry out this work safely and effectively. You will also learn how to assess the health of trees and shrubs, to recognise structural and pathological causes of potential failure, and to determine and carry out the appropriate remedial action.

This unit will help you to progress to further horticulture courses in higher education, or to apprenticeships or entry-level roles in the horticulture sector.

Learning aims

In this unit you will:

A Explore how pruning is used as a means of maintaining trees and shrubs
B Investigate how trees and shrubs are assessed for potential failure
C Carry out pruning and maintenance activities on trees and shrubs.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore how pruning is used as a means of maintaining trees and shrubs	**A1** Reasons for pruning and maintaining trees and shrubs **A2** Pruning techniques **A3** Considerations when pruning	A report on the importance of the pruning and maintenance of trees and shrubs, the techniques involved, and how to assess and treat trees and shrubs for potential failure.
B Investigate how trees and shrubs are assessed for potential failure	**B1** Assessing trees and shrubs for potential failure **B2** Remedial action to reduce risks of tree failure	
C Carry out pruning and maintenance activities on trees and shrubs	**C1** Pruning requirements **C2** Planning the pruning operation **C3** Carry out appropriate pruning	A log that covers the pruning and maintenance activities, with photographs and written commentary explaining the processes carried out.

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Content

Learning aim A: Explore how pruning is used as a means of maintaining trees and shrubs

A1 Reasons for pruning and maintaining trees and shrubs

- Promoting and maintaining the health of trees and shrubs.
- To reduce the spreading of diseases, e.g. coral spot, Dutch elm disease.
- To maintain plant vigour, balance and structural stability.
- To improve the aesthetics of the plant.

A2 Pruning techniques

- Formative pruning – preparing and getting the shape in the early stages of tree development.
- Tree pruning techniques, including crown thinning, crown reduction, crown lifting, and crown cleaning.
- Pruning techniques for trees and shrubs, including pollarding, coppicing, rejuvenation, root pruning.

A3 Considerations when pruning

- The required outcome, e.g. from the client, park manager.
- The seasonality and timing of pruning techniques for the type of tree/shrub.
- The selection of the appropriate technique suitable for the tree type within its particular growing area.
- The landscape where the tree/shrub sits.
- The legal considerations in terms of tree, planning and conservation regulations.
- The health and safety of operatives, and regulations around working at heights, harnessing, and personal liability insurance.

Learning aim B: Investigate how trees and shrubs are assessed for potential failure

B1 Assessing trees and shrubs for potential failure

Carrying out a risk assessment around the probability of tree failure:

- assessing potential failure area of trees dependent on tree type
- consideration of the form and branching characteristics
- evidence of structural weakness and imbalance
- impact of local construction work, changes in soil levels, potential hazards to public and property.

B2 Remedial action to reduce risks of tree failure

Possible solutions and considerations for remedial action:

- removal or pruning options outlined
- physical support, including propping, guying, bracing
- site improvement
- costs and benefits of remedial action proposed
- long- and short-term consequences
- consideration of health and safety legislation.

Learning aim C: Carry out pruning and maintenance activities on trees and shrubs

C1 Pruning requirements

- Methods of assessing pruning requirements and species identification, including plant characteristics consisting of natural size and form, age, vigour, health and physical damage.
- Seasonal pruning requirements in relation to aesthetic considerations and health and safety considerations.

C2 Planning the pruning operation

- Close the site, clear up, cordon sections off, give advance warning and notices.
- Planning the pruning operation – to carry out and consider:
  - risk assessment
  - weather conditions
  - access arrangements
  - public safety.
- Selecting appropriate pruning tools and equipment, e.g. types of hand tools.
- Access to equipment and personal protective equipment (PPE).

C3 Carry out appropriate pruning

- Using the appropriate methods, prune trees and shrubs appropriately according to their age, size and desired effect/use within the landscape.
- Pruning different plants, including evergreen shrubs, deciduous shrubs, hedges, wall shrubs, roses and trees.
- Site management in maintaining health and safety, disposal of waste and PPE.

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Assessment criteria

Pass	Merit	Distinction
Learning aim A: Explore how pruning is used as a means of maintaining trees and shrubs		**A.D1** Evaluate a wide range of pruning techniques and the factors that influence them, analysing their effectiveness in maintaining trees and shrubs.
A.P1 Explain why pruning is important to maintain trees and shrubs. **A.P2** Explain some of the factors that influence the selection of different pruning techniques.	**A.M1** Compare a range of pruning techniques and how they are used to maintain trees and shrubs, assessing their importance and the factors that influence their use.	
Learning aim B: Investigate how trees and shrubs are assessed for potential failure		**B.D2** Analyse the different methods for assessing trees and shrubs for failure, producing detailed solutions for prevention, remedial care and long-term management.
B.P3 Explain the methods used to assess trees and shrubs for failure. **B.P4** Produce outline solutions for how tree and shrub failure may be prevented or remedied.	**B.M2** Compare the different methods for assessing trees and shrubs for failure, producing solutions for how they may be prevented or remedied.	
Learning aim C: Carry out pruning and maintenance activities on trees and shrubs		**C.D3** Carry out thorough assessments for a wide range of trees and shrubs, selecting and using the appropriate tools confidently to complete pruning and maintenance activities.
C.P5 Carry out basic assessments of the pruning requirements for trees and shrubs. **C.P6** Carry out simple pruning and maintenance activities on trees and shrubs.	**C.M3** Carry out accurate assessments of the pruning requirements for a range of trees and shrubs, selecting tools to complete most of the required pruning and maintenance activities.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to pruning tools and equipment.

Essential information for assessment decisions

Learning aims A and B

For Distinction standard, learners will demonstrate a thorough understanding of the importance of pruning for the maintenance of trees and shrubs and the techniques involved, supported by a wide range of examples of specific plants, some of which have quite complex requirements. They will provide a comprehensive analysis of the advantages and disadvantages of different pruning techniques and approaches, suggesting improvements or changes that may be necessary to support the health of trees and shrubs. They will give examples of how to assess failure in trees and shrubs, giving detailed recommendations for the remedial action required and how to plan for the long-term management of possible failures. Learners will show throughout that they understand the importance of the legal implications of pruning and maintaining shrubs and trees, both in terms of health and safety and specific legislation relating to planning and conservation.

For Merit standard, learners will give clear and detailed information about the importance of the pruning and maintenance of trees and shrubs, supported with a range of examples. They will compare different pruning techniques and their outcomes, making some comments about the suitability, and the effectiveness of the desired outcome. They will give some information about the methods to assess potential failure in trees and shrubs and the remedial action required for them, showing some consideration of the long-term impact and maintenance plan.

For Pass standard, learners will give broad reasons for the pruning and maintenance of trees and shrubs, using a small range of examples, showing consideration of the needs of different landscapes. They will provide information on some of the basic methods for assessing potential failure in trees and shrubs, and suggest some suitable remedial action to reduce the failure and long-term loss of the tree/shrub.

Learning aim C

The assessment activity for learning aim C should cover pruning activities for the following types of tree and shrub: evergreen shrubs, deciduous shrubs, hedges, wall shrubs, roses and young trees. Tree access techniques and chainsaw use are not required.

For Distinction standard, learners will demonstrate confidence in assessing pruning requirements, selecting and using the correct equipment and tools for pruning trees and shrubs, resulting in skilful pruning. They must demonstrate the capacity to adapt techniques to the needs of the specific tree/shrub, such as taking account of natural size, form and age, and how pruning best manipulates the plant to improve the outcome in its habitat, while maintaining high standards of health and safety for self and others. Learners will work autonomously, solving problems efficiently and resourcefully.

For Merit standard, learners will assess the requirements of a range of trees and shrubs, selecting and using equipment and tools that are mostly appropriate, and which result in proficient pruning. They will show a consideration for the landscape and for the tree and shrub size and form. They will work mostly without help but may need some guidance for more complex techniques. They will work safely, showing a consideration for the setting and for others present.

For Pass standard, learners will demonstrate that they can assess some of the pruning requirements for a small range of trees and shrubs, and use the appropriate tools and equipment to prune them (although they may need some support in selecting them). They will also demonstrate that they can carry out some basic pruning techniques but may need some support in more complex situations.

Links to other units

This unit links to *Unit 1: Plant and Soil Science*.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses, from those such as gardeners, park managers
- technical workshops on pruning techniques from staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- reflective practices when considering pruning processes
- practical application when employing different maintenance activities
- safe working practices and procedures when pruning trees and shrubs.

Unit 31: Nursery Stock Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills to carry out tasks to successfully establish and maintain nursery stock.

Unit introduction

The nursery industry often forms a significant sector of a horticultural industry. Nurseries grow and sell plants for private or commercial use, either selling wholesale or directly to customers online or through garden centres and other retail outlets. A nursery can produce stock grown and cultivated in fields or produced in containers and greenhouses.

In this unit, you will explore the range of field- and container-grown crops and plants, and their particular requirements for growth such as soil type and pH, slope of the land, climate, water quality, and access to irrigation and availability of labour. You will consider the various methods of maintaining and controlling growth, and how to deal with common pests and diseases. You will then put together a plan and timeline for some nursery stock and carry out the tasks required to establish and maintain it.

This unit will help you to progress to further horticulture courses in higher education, or to apprenticeships or entry-level roles in nurseries.

Learning aims

In this unit you will:

A Explore the requirements for the production and establishment of field- and container-grown nursery stock

B Plan for the management and establishment of given field and container nursery stock

C Undertake production and establishment activities for specified nursery stock.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore the requirements for the production and establishment of field- and container-grown nursery stock	**A1** Plant suitability for field- and container-grown nursery stock **A2** Site selection and growing conditions for nursery stock **A3** Resource requirements **A4** Factors affecting the management of plant growth and establishment	A report on the requirements and factors for the production and establishment of field and container plants as nursery stock.
B Plan for the management and establishment of given field and container nursery stock	**B1** Planning for nursery stock production	Planning documents showing the timelines of activities that cover the key tasks, techniques and factors for the production and establishment of field-grown and container-grown nursery stock. A portfolio of evidence of practical tasks carried out.
C Undertake production and establishment activities for specified nursery stock	**C1** Cultivation, establishment and harvest of nursery stock	

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Content

Learning aim A: Explore the requirements for the production and establishment of field- and container-grown nursery stock

A1 Plant suitability for field- and container-grown nursery stock

Categorising plants into field and container grown, considering age, size and intended market.

- Plant types:
  - trees, including fruit and ornamental
  - shrubs, including evergreen and deciduous
  - fruit bushes/canes
  - conifers
  - hedging plants
  - climbers
  - herbaceous perennials
  - heathers
  - grasses
  - alpines
  - roses.
- Types of plant production for field stock – seed, seedlings, budded stock, grafted stock, bare root, root balled, including grading of each type.
- Types of plant production for container stock – cuttings, including softwood, semi-ripe, hardwood; plugs, liners, potting on, specimen plants, buying in stock.

A2 Site selection and growing conditions for nursery stock

- Site considerations for field-grown stock:
  - soil, including structure, texture, pH, depth, fertility, drainage; seasonal characteristics, including drought, frost, waterlogging
  - aspect, topography, exposure, protection
  - access requirements to site for growing and harvesting operations
  - services available for irrigation purposes or obtaining a water-abstraction licence
  - characteristics of site that may impact on choice of plants.
- Container growing area requirements:
  - growing medium, including soil-based and soil-free, peat and peat-free mixes
  - growing medium additions, including sand, horticultural grit, perlite, vermiculite, and nutrients
  - seed and propagation beds, including indoor, outdoor, heated and unheated, lining out beds, growing beds, polytunnels, shade tunnels, hardening-off areas, benching, standing areas, display beds
  - irrigation options, including overhead lines; sprinklers, including individual, line, static and mobile; drip-lines or flood benches with capillary matting, mist benches, hose and lance, soak trays, watering can.

A3 Resource requirements

Establishing the requirements for a nursery, considering the type and size for both field- and container-grown stock.

- Work area requirements:
  - buildings and structures for tasks, including potting on and propagation; storage of plants, tools, machinery, equipment and materials; areas for preparing; safe chemical storage; packing orders for dispatch; waste disposal for both hazardous and non-hazardous waste
  - tools and equipment for field, e.g. forks, lifting and digging spades, secateurs, trowels, dibbers; materials, including string lines, root-ball netting, labels; machinery, including undercutters, tractors, trailers, cultivators
  - tools and equipment for containers, e.g. spades, shovels, scoops, dibbers, secateurs, potting machine, trolleys, barrows; materials, including containers, labels.

A4 Factors affecting the management of plant growth and establishment

- Managing plant growth:
  - growing space available, spacing correctly for time of year, stage of development, shape and size of plant, pruning, trimming, providing support.
- Plant monitoring and control of environmental factors:
  - light, water, humidity, temperature, ventilation, protection.
- Managing the health of nursery stock:
  - monitoring and control of pests, including molluscs, mites, insects, weevils, rodents, mammals; diseases, including fungal, bacterial; viruses and disorders, including nutrient deficiencies, climatic effects, mechanical damage, pollutants, hygiene
  - application of feed, including requirements for major, macro and micronutrients, top dressing, base dressing, granules, powers, liquid, slow release, fertigation.
- Key principles of legislation and regulations governing safe working, to consider:
  - health and safety at work legislation
  - personal protective equipment at work legislation
  - food and environment protection legislation
  - safe use of chemicals
  - safe use of work equipment
  - risk assessment requirements.

Learning aim B: Plan for the management and establishment of given field and container nursery stock

B1 Planning for nursery stock production

- Assessment and management of hazards and risks in work area, e.g. uses and storage of tools, equipment and chemicals, personal protective equipment (PPE), safety signage.
- Resources required to produce nursery stock, including cost and availability, e.g. equipment, materials and personnel.
- Factors affecting timeline planning, to include:
  - natural growth times of selected stock
  - work schedules for planting, maintenance and harvest
  - contingency planning for production problems, e.g. adverse weather
  - production timings of plants, seasonal marketing considerations, production costing versus pricing.

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Learning aim C: Undertake production and establishment activities for specified nursery stock

C1 Cultivation, establishment and harvest of nursery stock

- Preparation of growth area.
- Selection and use of correct tools, machinery, equipment and materials for specified production task:
  - field-production tools, e.g. lifting and digging spades, secateurs, trowels, dibbers; materials, e.g. string lines, root-ball netting, labels; machinery, e.g. undercutters, tractors, trailers, cultivators
  - container-production tools, e.g. spades, shovels, scoops, dibbers, secateurs; equipment, e.g. potting machine, trolleys, barrows; materials, e.g. containers, labels.
- Planting:
  - production tasks for nursery stock during different stages of development as appropriate, e.g. preparing ground, planting, potting up, potting on
  - provide growing conditions to suit specified nursery stock establishment, including light, water, humidity, temperature, ventilation, protection, spacing to suit stage of development, shape and size of plant
  - work safely, minimising damage to working area; disposing of waste correctly.
- Maintenance and monitoring:
  - prune, tidy, support; provide protection as appropriate to plant, time of year and weather conditions
  - remove weeds, feed and water plants as appropriate.
- Nursery stock health checks:
  - pests, diseases and disorders, good hygiene practices.
- Selection and use of harvest methods appropriate to plant type:
  - ensure nursery stock meets specification, including uniform growth, high quality, clean, tidy, healthy, correct labelling.
- Work safely, minimising damage to working area; disposing of waste correctly.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Explore the requirements for the production and establishment of field- and container-grown nursery stock		**A.D1** Analyse the requirements for a wide range of plant categories for field- and container-grown nursery stock, evaluating the factors that affect their successful growth and establishment.
A.P1 Explain the requirements for the production of field- and container-grown nursery stock. **A.P2** Explain the factors that affect the management of plant growth and establishment in field- and container-grown nursery stock.	**A.M1** Compare the requirements for a range of different plant categories for field-and container-grown nursery stock, assessing the factors that affect their growth and establishment.	
Learning aim B: Plan for the management and establishment of given field and container nursery stock		**B.D2** Produce a comprehensive plan and accurate timelines for the management and establishment of specified nursery stock, including contingency planning.
B.P3 Produce a simple plan with some details for the management and establishment of specified nursery stock. **B.P4** Produce outline timelines for the management and establishment of specified nursery stock.	**B.M2** Produce a detailed plan for the management and establishment of specified nursery stock, which includes accurate timelines and work schedules.	
Learning aim C: Undertake production and establishment activities for specified nursery stock		**C.D3** Carry out production and establishment activities confidently, demonstrating a comprehensive understanding of the methods required for the specified nursery stock.
C.P5 Carry out basic preparation and planting activities for specified nursery stock. **C.P6** Carry out simple maintenance tasks for specified nursery stock, selecting and using the appropriate tools.	**C.M3** Carry out production and establishment activities effectively, working to the required timelines and using appropriate methods for the specified nursery stock.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of nursery stock plants to work with (these can be field grown or container grown)
- a nursery stock area to prepare and establish plants
- appropriate, well-maintained tools, equipment and materials for carrying out nursery stock tasks
- suitable PPE
- a library with a range of books, brochures and catalogues, and the internet for research.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give a comprehensive account of the production requirements for a range of plants, using examples that have quite complex needs. They will make clear links between how production requirements and their timings can affect the successful establishment of nursery stock.

Learners will carry out a thorough review of the factors that affect the management of plant growth across both field- and container-grown nursery stock, coming to some conclusions regarding which factors are the most important. Learners will use technical terms confidently, using the full and accurate botanical names for plants.

For Merit standard, learners will give a detailed account of the production requirements for plants from field- and container-grown nursery stock, which have a range of different needs. They will make comparisons between the field- and container-grown stock and assess how the timings of them can affect their successful establishment.

Learners will present their work in a well-organised way and make reference to the botanical plant names.

For Pass standard, learners will identify some of the key requirements for producing both field- and container-grown nursery stock, using examples of plants that have quite similar needs. They will show they understand the production requirements and will demonstrate an understanding of the timing of these. Learners will state the main factors that affect establishment of nursery stock plants. Learners will present information accurately, showing they have an understanding of some of the botanical plant names.

Learning aims B and C

For Distinction standard, learners will produce a comprehensive plan, which includes detailed and accurate timelines for planting and maintenance, showing a depth of understanding of the tasks and timings required and with contingency planning, including how to ensure the successful establishment and maintenance of the nursery stock.

Learners will consistently carry out the practical tasks to a high standard, selecting the correct tools and equipment, and showing an understanding of any health and safety issues. Learners will show a comprehensive understanding of the plants they are working with and how they meet specifications.

For Merit standard, learners will produce a plan that covers in detail the resources required, the natural growth times of the nursery stock, and includes timelines that plan out the work schedule for maintenance and harvest. They will include some details on how to manage risks.

For their practical tasks, learners will demonstrate that they can work safely and organise themselves to carry out the required tasks efficiently. They will select and use tools, equipment and materials suitable for the tasks being completed. Learners will demonstrate a sound knowledge of the plants they are working with, being able to assess their requirements accurately to meet specifications.

For Pass standard, learners will plan out the essential tasks required for the management and establishment of the nursery stock but will not go into detail about the finer requirements. They will produce a timeline for key activities, which will consider some of the factors for maintenance and harvest.

Learners will complete basic practical tasks for the production, establishment and maintenance of the nursery stock, showing they can work safely and have an awareness of risks when carrying out their work. They will use tools, equipment and materials to suit the task given.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 7: Work Experience in the Land-based Sectors.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- support from a local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills when investigating propagation of nursery stock
- personal skills when working with others
- self-management skills when managing working schedules.

Unit 32: Maintenance of Sports and Amenity Turf

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills needed to manage the maintenance of sports and amenity turf areas. They will develop a maintenance plan and work from this during practical tasks.

Unit introduction

The management of turf is needed in many different areas. Being able to manage turf maintenance is the key to its success. The areas can range from sports facilities such as golf courses that require well-planned daily maintenance, to parks and gardens that have less intensive requirements.

In this unit, you will look at the management and maintenance of both sports and amenity turf. You will research a range of maintenance tasks and look at how often these tasks need to be carried out for various sports and amenity areas. With this knowledge, you will produce a maintenance plan for a given area of turf, and complete some practical maintenance tasks from it on the given area. Practical tasks will then be evaluated against the requirements and standards of the area. Understanding turf requirements, planning maintenance, and evaluating against performance quality standards will mean your turf will be successful in supporting play or recreation for years to come.

This unit will give you the skills to identify, plan for and carry out maintenance tasks for an area of turf. These skills are a huge advantage for progression to employment in roles such as a golf greenkeeper, sports groundsman, a gardener in the grounds of a stately home, or an expert who recommends and sells plants in a garden centre. Alternatively, you may wish to progress to higher education, for example to a horticulture degree.

Learning aims

In this unit you will:

A Investigate the maintenance requirements of sports and amenity turf

B Plan a schedule for a given area of turf to support its maintenance

C Carry out maintenance for a given area of turf to enhance turf quality.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the maintenance requirements of sports and amenity turf	**A1** Maintenance operations of sports and amenity turf **A2** Factors that affect maintenance operations **A3** Repair and renovation requirements of sports and amenity turf	A report exploring the maintenance requirements of sports and amenity turf and the impact on the quality of turf.
B Plan a schedule for a given area of turf to support its maintenance	**B1** Planning sports and amenity turf maintenance **B2** Seasonal impacts on maintenance planning for sports and amenity turf **B3** Key features of a turf maintenance plan	Evidence includes: • a maintenance plan for a given area of turf • photographic evidence of maintenance tasks carried out • a report on the effect of maintenance on the quality of turf.
C Carry out maintenance for a given area of turf to enhance turf quality	**C1** Preparing to undertake sports and amenity turf maintenance **C2** Completing maintenance tasks **C3** Review of outcomes of maintenance tasks	

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Content

Learning aim A: Investigate the maintenance requirements of sports and amenity turf

A1 Maintenance operations of sports and amenity turf

- Areas of sports turf, e.g. football/soccer pitches, golf courses, bowling greens, athletics tracks.
- Areas of amenity turf areas, e.g. parks, gardens, recreational areas.
- Maintenance operations and their considerations in terms of type, frequency, maintaining health, meeting requirements of sport or area:
  - mowing
  - scarifying, verticutting, grooming
  - aeration
  - rolling
  - switching/brushing
  - edging.
- Feeding of turf, including summer and winter programmes; applications, including top-dressing, granular, liquid, controlled release.
- Irrigation methods, including summer and winter programmes, automated pop-up systems, oscillating sprinklers, hand watering, boom sprayers, self-propelled/travelling watering systems.
- Range of tools and equipment to plan and manage maintenance, including knowing which tools to use for which situation.
- Pedestrian machinery:
  - mowers, e.g. rotary, cylinder, hover
  - scarifier
  - aerator
  - turf cutter
  - backpack leaf blower
  - knapsack sprayer
  - fertiliser spreader.
- Ride-on machinery:
  - mowers
  - tractors and mounted attachments
  - sprayers
  - gator
  - ATV, quad.
- Hand tools:
  - rakes
  - half moon
  - switch
  - spade
  - shovel
  - fork.

- Powered hand tools:
  - strimmers and brush cutters
  - hand-held leaf blower.
- Essential maintenance requirements of tools, equipment and machinery.

A2 Factors that affect maintenance operations

Health of turf, inspection, impact and positive identification of threats to turf health to include:

- Pests, such as:
  - chafer grubs, worm casts, leatherjackets, moles, rabbits, birds, earthworms.
- Diseases, such as:
  - fusarium, anthracnose, red thread, dollar spot, rust, fairy rings.
- Disorders, such as:
  - dry patch, black layer, chemical damage, thatch, compaction, waterlogging, machinery damage, man-made damage.
- Moss.
- Responding to threats to sports turf, through:
  - physical methods, e.g. by hand and machine
  - chemical methods, e.g. fungicides, pesticides, herbicides, growth regulators, wetting agents
  - biological methods, e.g. the use of bacteria, fungi or nematodes
  - cultural methods, e.g. regular maintenance operations.

A3 Repair and renovation requirements of sports and amenity turf

Selection of the correct repair or renovation method.

- Types of repair and renovation, including:
  - patching
  - plugging
  - divotting
  - over-seeding
  - forking-up
  - re-turfing
  - re-seeding.
- Assessment of area requiring repair or renovation, including extent of damage; most suitable method, including size of area, time of year, area usage, play requirements, resource requirements; costs involved, including time it takes to complete task and time it takes the area to re-establish.
- Factors affecting repair and renovation, including soil type and condition, timings, methods used, weather.

Learning aim B: Plan a schedule for a given area of turf to support its maintenance

B1 Planning sports and amenity turf maintenance

Area of maintenance being planned, and type and frequency of maintenance operations.

- Characteristics of sports and amenity turf areas, including soil, aspect, topography, air movement.
- Aims of maintenance, e.g. to improve grass cover, to improve health of turf, to reduce weeds, to improve drainage, to reduce compaction.
- Objectives to achieve aims, e.g. remove debris from area, dispose of all waste correctly, over-seed area of maintenance operations; resource planning.
- Meeting performance quality standards (PQS) and requirements of governing organisations and professional bodies involved in sports and amenity turf, including:
  - Institute of Groundsmanship (IOG)
  - British and International Golf Greenkeepers Association Limited (BIGGA)
  - Sports Turf Research Institute (STRI)
  - Chartered Institute for the Management of Sport and Physical Activity (CIMSPA).
- Meeting current legal/legislative requirements, including:
  - health and safety at work legislation
  - safe use of chemicals
  - safe use of work equipment
  - reporting of injuries
  - manual handling operations legislation
  - environmental legislation
  - waste disposal regulations.

B2 Seasonal impacts on maintenance planning for sports and amenity turf

- The effects of seasons, including operations; climate, aspect and soil.
- Weather and climate, forecast, average weather conditions, precipitation, shade, frost, maximum and minimum temperatures, air movement, extreme weather events.

B3 Key features of a turf maintenance plan

- Key areas that should be included in a maintenance plan:
  - location, characteristics and limitation of the land
  - aims and objectives, e.g. what needs to be achieved and the steps taken towards that aim
  - resource requirements, e.g. tools, equipment, machinery, personnel
  - legal requirements, e.g. risk assessments, staff training requirements such as pesticide applications (PA1, PA2, PA6)/international equivalents
  - costs, e.g. staff, materials and resources
  - maintenance operation timings
  - contingency planning for poor weather, staff sickness, unfavourable ground conditions, machinery unavailable, and dealing with problems and issues.
- Document format to suit area being planned, e.g. wall planners, diaries; spreadsheets, including dates, week numbers; key event planning.

Learning aim C: Carry out maintenance for a given area of turf to enhance turf quality

C1 Preparing to undertake sports and amenity turf maintenance

- Assessment of risk and working safely:
  - identification of hazards and risks of the work area (related to tools, equipment and people) and how these can be minimised, including essential personal protective equipment (PPE)
  - methods for working safely and minimising damage to working areas.
- Correct tools, materials and equipment to maintain turf areas:
  - selection of tools, equipment and machinery relevant to area of maintenance
  - transportation of tools, equipment and machinery to area of maintenance safely.
- Assessment of area before tasks:
  - suitable condition for maintenance task, including assessment of ground and weather conditions
  - removal of debris, organic and inorganic waste before maintenance tasks and correct disposal.

C2 Completing maintenance tasks

Safe completion of maintenance tasks to suit area of turf, time of year and working from the plan.

- Maintenance:
  - safe working practices, e.g. safe use of equipment, appropriate training, lone working, public right of way; compliance with relevant legislation, codes of practice and work specifications, e.g. wearing correct PPE, following risk assessments and minimising risk
  - correct use, maintenance and storage of tools, materials, machinery and equipment
  - safe completion of maintenance tasks
  - minimising environmental damage and maintaining site conditions while carrying out maintenance tasks, e.g. debris removal control, minimising public access, turf conditions
  - area of work left tidy and presentable, using markers, signs or ground under repair (GUR) or no play zone (NPZ) signs where appropriate; safe disposal of waste, including organic and inorganic.

C3 Review of outcomes of maintenance tasks

Review, to include:

- checking performance quality standards (PQS) are meeting basic recreational use, standard club use and high national or international competition use
- checking the requirements of the turf area are met, e.g. adequate grass cover, low level of weed coverage, turf is in good health
- effectiveness of maintenance tasks, e.g. area improvements seen, growth improvements
- measuring actual outcomes against planned outcomes, e.g. inspection and monitoring areas
- impact of maintenance tasks and the link to enhancing the quality of the turf
- how the review process can inform future strategies – lessons learned, identified improvements, recommendations for improvement
- recording results on the maintenance plan.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Investigate the maintenance requirements of sports and amenity turf</td><td rowspan="2">A.D1 Analyse the maintenance requirements of sports and amenity turf, demonstrating an in-depth understanding of how maintenance enhances their quality, giving detailed examples.</td></tr>
<tr><td>A.P1 Explain the maintenance requirements of sports and amenity turf areas with some examples of the methods used.
A.P2 Explain how maintenance enhances the quality of sports and amenity turf.</td><td>A.M1 Assess the maintenance requirements of sports and amenity turf, and how these methods enhance their quality, giving relevant examples.</td></tr>
<tr><td colspan="2">Learning aim B: Plan a schedule for a given area of turf to support its maintenance</td><td rowspan="2">B.D2 Produce a comprehensive maintenance plan for a given area of turf, giving a detailed rationale for approaches taken.</td></tr>
<tr><td>B.P3 Produce a basic maintenance plan for a given area of turf.
B.P4 Explain decisions made when planning maintenance for the given area.</td><td>B.M2 Produce a detailed maintenance plan for a given area of turf, giving a clear rationale for approaches taken.</td></tr>
<tr><td colspan="2">Learning aim C: Carry out maintenance for a given area of turf to enhance turf quality</td><td rowspan="2">C.D3 Demonstrate a thorough and effective approach to the maintenance of a given area of turf, analysing the impact of own maintenance plan on the quality of turf.</td></tr>
<tr><td>C.P5 Demonstrate competent maintenance of a given area of turf, using the appropriate methods and safe processes.
C.P6 Explain contribution of own maintenance plan in enhancing quality of turf.</td><td>C.M3 Demonstrate efficient maintenance of a given area of turf, showing a clear consideration of the environment and site conditions.
C.M4 Assess the contribution of own maintenance plan on the quality of a given area of turf.</td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, C.M4, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of sports turf and amenity areas to visit (this can be off site)
- an area of sports or amenity turf to plan and carry out maintenance
- appropriate, well-maintained tools, machinery, equipment and materials for carrying out turf maintenance tasks
- suitable PPE
- a library with a range of books, brochures and catalogues, and the internet for research.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will provide a thorough and detailed account of the maintenance requirements of sports and amenity turf areas. They will demonstrate a depth of understanding of the different requirements of turf areas and the relationship to turf maintenance.

Learners will present a comprehensive account of how effective maintenance enhances the quality of turf, giving robust examples of maintenance activities, how they enhance quality, and a depth of knowledge that shows links between the health of turf and a robust maintenance plan.

Learners will give full, detailed information on the factors that affect maintenance operations, and will recommend ways of overcoming these effectively. Learners will also draw on a depth of knowledge from their learning to accurately identify damage to turf and its causes, and then fully justify the types of repair or renovation tasks that are most appropriate for the area.

Learners will use accurate technical terminology relating to maintenance operations throughout.

For Merit standard, learners will fully examine the maintenance requirements of a range of sports and amenity turf areas. They will demonstrate a clear understanding of the different requirements of turf areas and the relationship to turf maintenance.

Learners will present a full account of how effective maintenance enhances the quality of turf, giving relevant examples of how regular maintenance activities can ensure quality is maintained.

Learners will give clear examples of the factors that affect maintenance operations, and the need to take these factors into consideration when planning a maintenance schedule. Learners will show they understand a range of causes of damage to turf and will provide recommendations for repair or renovation tasks that are appropriate to the area. Learners will use mostly correct technical terminology relating to maintenance operations.

For Pass standard, learners will produce an account of the maintenance requirements for a small range of sports and amenity turf areas, making broad links between the different turf areas and their maintenance requirements. Learners will explain how effective maintenance enhances the quality of turf and show some consideration of the factors that affect maintenance operations. They will give examples of the damage that may occur in some turf areas and make outline suggestions on the appropriate repair or renovation method. Learners will use some appropriate technical terminology related to maintenance operations but there may be some inconsistencies.

Learning aims B and C

The assessment requires a given area to plan for and carry out maintenance tasks.

For Distinction standard, learners will demonstrate clear and detailed reasoning for the approach taken for the maintenance of a given area of turf, through a thorough examination of the area. Learners will consider all relevant aspects that may affect successful maintenance and the quality of the turf. This will include giving full details of the requirements for successful maintenance, and making detailed links to the site conditions.

Learners will produce a comprehensive maintenance plan for a given area of turf, including detailed aims and objectives that accurately meet the needs of the given area, effective weekly tasks with timings, and resource planning. The plan will show robust organisation of tasks, and learners will fully justify their decisions in relation to the suitability of the tasks to be carried out.

Learners will evidence clear ways to minimise risks and fully demonstrate competent safe working practices throughout. They will select correct tools, materials and equipment, using them safely and to industry standard. Learners will carry out maintenance that is effective in supporting the quality of turf. They will draw on knowledge from their learning to reflect on the decisions they made during the practical tasks carried out.

Learners will show a comprehensive understanding of turf requirements that supports the quality of turf before and during maintenance. Effective care of the turf will be provided throughout. Learners will review the methods they used for maintenance and thoroughly explore where they were successful and where methods could be improved or carried out differently.

For Merit standard, learners will demonstrate they have assessed the given area to establish the maintenance requirements that match the site conditions, and the links to successful maintenance. They will give reasons for their approach, supported by examples.

Learners will produce a detailed maintenance plan for a given area of turf that identifies aims and objectives, weekly detailed tasks and resource requirements.

Learners will carry out maintenance, showing they have optimised the given area through the preparation of the turf, and by demonstrating efficiency in the time taken, the resources used and the minimal disruption during the maintenance tasks. They will draw on their knowledge to consider ground conditions and prepare the area appropriately. They will assess the hazards and risks involved in carrying out the practical tasks and use the required tools, materials and equipment safely and competently.

Learners will show detailed knowledge of maintenance requirements to enhance the quality of the given area. They will reflect on the methods they used and make clear connections to their impact on the successful maintenance of the given area.

For Pass standard, learners will provide details of the features and characteristics of a given area of turf, demonstrating an understanding of the given area, maintenance requirements and any limiting factors.

Learners will produce a simple maintenance plan, outlining the features and characteristics of a given area and taking account of these aspects and giving their reasons for the maintenance tasks included in their plan for the given area.

Learners will work safely, with an awareness of the risks and potential issues arising when carrying out maintenance tasks. Learners will use appropriate methods, tools and equipment to prepare the area and carry out maintenance tasks, leaving the area clean and tidy on completion. On completion of tasks, learners will safely remove and store tools, materials and equipment, disposing of waste materials appropriately.

Learners will provide reasons for their selected methods of maintenance, demonstrating some understanding of the impact these methods have on maintaining the quality of turf.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 2: Estate Skills
- Unit 7: Work Experience in the Land-based Sectors.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills when investigating requirements of different turf types
- presentation and formal written communication skills when communicating maintenance plans
- self-management and planning skills when completing responsible and environmentally friendly turf maintenance techniques.

Unit 33: Pests and Disease in Plants

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills required to identify, prevent and control common pests and disease in plants.

Unit introduction

Pests and diseases can have a significant negative effect on the visual condition of plants and trees, not to mention the economic impacts they can have on production. Knowing what is wrong with a plant, along with the best way to manage the problem, is essential for productive and healthy plants.

In this unit, you will discover the features of a range of pathogens, which can affect plants, including trees, grasses and ornamental plants. You will study how to identify plants and pathogens, along with the signs and symptoms that indicate a plant is under attack from a particular pest or disease. You will explore how to manage plant pathogens using different methods, equipment and techniques in both organic and conventional systems as well as carrying out your own practical investigations into plant health management.

This unit will support your progression to employment in the land-based sector, or to further study in an apprenticeship or higher-education establishment.

Learning aims

In this unit you will:

A Examine pests and diseases for management of plant health
B Explore strategies for managing plant health
C Undertake monitoring, prevention and control for effective plant health management.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Examine pests and diseases for management of plant health	**A1** Pests and diseases **A2** Signs and symptoms of plant pests and diseases	A report on the identification, spread, reproduction and effect of pests and diseases in plant health management.
B Explore strategies for managing plant health	**B1** Prevention and control strategies **B2** Legislation relating to plant and tree health	Justified strategies for a given scenario for organic and conventional systems for plant health management. Photographic evidence of the practical activities carried out, supported by learners' logs and observation statements from tutors and/or employers.
C Undertake monitoring, prevention and control for effective plant health management	**C1** Monitoring and surveillance methods **C2** Preventing and controlling plant pathogens	

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Content

Learning aim A: Examine pests and diseases for management of plant health

The purposes and processes involved in organism identification to determine appropriate health management strategies for pests and diseases affecting particular plants and trees in varying life stages.

A1 Pests and diseases

Common pests and diseases affecting turf, plants and trees.

- Insect pest species e.g:
  - true bugs (Hemiptera)
  - wasps (Hymenoptera)
  - butterflies and moths (Lepidoptera)
  - beetles (Coleoptera)
  - crane flies (*Tipula*)
  - chafers (*Phyllopertha horticola*)
  - grass flies, e.g. *Meromyza* spp.
- Gastropod pests, e.g. *Deroceras*, *Arion*, *Tandonia* spp.
- Animal pests, e.g. locusts, grey squirrels (*Sciurus*), deer (*Cervidae*), and birds.
- Fungal diseases caused by species of *Ascomycota*, e.g.:
  - apple canker and coral spot (*Nectria*)
  - powdery mildew (*Erysiphales*)
  - fusarium patch (*Microdochium*)
  - black spot (*Diplocarpon*)
  - take-all (*Gaeumannomyces*)
  - Dutch elm disease (*Ophiostoma ulmi*)
  - Sclerotinia disease (*Sclerotinia*)
  - ash dieback disease (*Hymenoscyphus fraxineus*, *Hymenoscyphus pseudoalbidus*).
- Fungal diseases caused by species of *Basidiomycota*, e.g.:
  - bracket fungus (*Ganoderma*)
  - smuts and bunts (*Tilletia*)
  - rusts (*Puccinia*)
  - honey fungus (*Armillaria*)
  - fairy rings, e.g. *Marasmius oreades*.
- Fungal diseases caused by species of *Oomycota*, e.g. *Phytophthora* and *Plasmopara* spp.
- Bacterial pathogens, e.g. *Xanthomonas*, *Pseudomonas*.
- Viral pathogens, e.g. cucumber mosaic virus (CMV), plum pox, cassava mosaic virus.
- Features of biotic pests and pathogens, as appropriate to insect and animal pests, fungal, bacterial and viral pathogens:
  - life cycles and their significance
  - reproduction methods and rates
  - breeding seasons
  - behavioural characteristics

  - growth and development
  - social structure
  - preferred habitat and food supply
  - natural population controls, e.g. diseases, parasites and natural mortality.
- Mode of movement of pests and pathogens:
  - natural spread, e.g. wind, territory
  - vectors, to include arthropods and animals
  - fomites, e.g. vehicles, machinery.

A2 Signs and symptoms of plant pests and diseases

The effects of pests, diseases and abiotic factors on health status, mechanisms of action, and consequences of not addressing issues early, as appropriate.

- Leaf changes:
  - colour
  - structural damage
  - defoliation.
- Trunk, stem and limbs:
  - fissures
  - cracks
  - stripped bark
  - fruitifications
  - shoot distortion.
- Rot types, to include root, seed and wood.
- General signs:
  - dieback
  - premature senescence
  - effects on seed and fruit formation and yield.
- Abiotic and seasonal factors that may impact on pest and disease status:
  - water-related, to include drought, waterlogging, water pollution
  - weather-related, to include frost, shade, sun scorching
  - damage, to include mechanical and herbicidal
  - soil-related, to include poor soil aeration, nutrient deficiencies or excesses.

Learning aim B: Explore strategies for managing plant health

B1 Prevention and control strategies

Purposes, suitability, advantages and disadvantages of methods used to prevent and control pests and diseases of plants in domestic and commercial situations.

- Selection of suitable species and promotion of healthy growth, e.g. irrigation, drainage, nutrition, companion planting.
- Breeding for natural resistance and disease tolerance.
- Culling of pest species, biological control methods.
- Maintenance programmes and application of substances, to include rotation of use as appropriate, e.g. pesticides, fungicides, deterrents.
- Pruning, mowing.
- Sanitation felling.

B2 Legislation relating to plant and tree health

The economic and conservation importance of plant and tree health laws/legislation, and the responsibilities and reporting procedures required for compliance. Legislation and procedures current at the time of teaching must be used.

- Requirements for and procedures involved in formal reporting of pests and diseases, such as those that follow, to relevant authorities:
  - beetles, e.g. *Diabrotica* spp
  - bugs, e.g. wheat bug (*Nysius huttoni*)
  - caterpillars, e.g. palm borer (*Paysandisia archon*)
  - mites, e.g. fuchsia gall mite (*Aculops fuchsiae*)
  - nematodes, e.g. *Meloidogyne fallax*
  - flies, e.g. *Liriomyza* spp
  - bacterial disease, e.g. *Xanthomonas arboricola* pv. *pruni*, *Xylella fastidiosa*
  - fungal disease, e.g. *Phytophthora ramorum*
  - viral disease, e.g. plum pox virus (sharka).
- Requirements for certification for organic production, e.g. registration with approved national organic control bodies, timeframes for certification.
- Laws/requirements when planning for and using pesticides.

Learning aim C: Undertake monitoring, prevention and control for effective plant health management

C1 Monitoring and surveillance methods

Purposes, techniques, equipment, procedures, advantages and disadvantages of methods used to monitor pests and disease in plants and trees.

- Recording and assessment methods, e.g. use of field data sheets, software, graphical representation of changes over time.
- Health status markers:
  - general appearance of individual and surrounding plants and trees
  - timing, frequency and type of damage and/or decay.
- Identification of pests and disease, e.g. use of hand lenses, digital cameras, sample preservation.
- Signs of pests, e.g. trapping of invertebrates, presence of faeces and classic signs of damage from larger animals.

C2 Preventing and controlling plant pathogens

Techniques, equipment, processes and timescales involved in the prevention and control of diseases in both organic and conventional production systems for domestic and commercial applications.

- Integrated pest and disease management (IPDM) planning.
- Safe use of treatments, e.g. liquids, sprays, powders.
- Pruning.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Examine pests and diseases for management of plant health		**A.D1** Evaluate the impact of a wide range of pests and diseases on the management of plant health.
A.P1 Explain how common pests and diseases can be identified in plants. **A.P2** Explain how common pests and diseases affect the management of plant health.	**A.M1** Assess the characteristics of pests and diseases that affect plants and their impact on the management of plant health.	
Learning aim B: Explore strategies for managing plant health		**B.D2** Analyse the factors to consider for the management of plant health, justifying the selection of health management strategies for the control of pests and diseases.
B.P3 Explain the factors to consider for the management of plant health. **B.P4** Select health management strategies for prevention and control of pests and diseases of plants.	**B.M2** Assess the factors to consider for the management of plant health, selecting appropriate strategies for their prevention and control.	
Learning aim C: Undertake monitoring, prevention and control for effective plant health management		**C.D3** Demonstrate a confident use of monitoring, prevention and control methods across a range of plants and sites, evaluating their effectiveness in the control of pests and disease in plants.
C.P5 Carry out basic monitoring activities for the control of pests and diseases in plants. **C.P6** Demonstrate use of basic prevention and control methods, reviewing their effectiveness in the control of pests and disease in plants.	**C.M3** Demonstrate use of relevant monitoring, prevention and control methods for plants across multiple sites, assessing their effectiveness in the control of pests and disease in plants.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of plants and trees in different habitats
- images and samples of common pests
- images and samples of plants affected by common pests and diseases
- a range of equipment and methods used to monitor, prevent and control pests and diseases.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give a wide-ranging account of common and uncommon pests and diseases that are relevant to the health management of plants. They will provide a comprehensive overview that links features such as life cycle, reproduction, preferred habitats and modes of movement with particular geographical locations and species of plants/trees. Learners will demonstrate a thorough understanding of the similarities and differences among different pests and diseases, the reasons for signs and symptoms of pathogens in plants, and the importance of correctly identifying both host and pest/disease for effective health management.

For Merit standard, learners will provide detailed accounts of the features of common pests and diseases, such as the different parts of their life cycles and modes of movement and spread. Learners will give careful consideration to the varied factors affecting the susceptibility of plants to pests and diseases, coming to a reasoned conclusion of how and why they affect their hosts.

For Pass standard, learners will cover pests and diseases that affect plants, which are common problems in their sector. They will demonstrate a basic understanding of fungi, bacteria, viruses, insects, gastropods, mammals and large animals that may affect particular plants. Learners will outline the characteristics of the organisms, their effects on plants and how these can be used in combination for identification purposes.

Learning aims B and C

For Distinction standard, learners will demonstrate a holistic understanding of effective plant health management. They will give a comprehensive account of organic and conventional pest and disease management in both domestic and commercial contexts. Learners will comment on the future impact of current prevention and control strategies, including the relevance of plant health legislation or international equivalents. Learners will justify decisions made for managing plant health and make recommendations based on the effectiveness of methods used to monitor, prevent and control pests and disease. They will work with little need for intervention. Written work will be logically structured, coherently written and illustrated appropriately throughout, while standards of practical work will be to at least merit level.

For Merit standard, learners will demonstrate a good understanding of different methods of monitoring, preventing and controlling pests and disease, identifying the most suitable methods to use after careful consideration of the factors affecting a given situation, such as the need to prevent disease in a certified organic system. This will include an awareness of the purpose and responsibilities under regulation and legislation or international equivalents. Learners will carry out techniques in a manner that demonstrates familiarity with the correct methods to achieve the desired outcomes. Their depth of understanding and skill will be evident in their ability to effectively manage more complex situations such as the monitoring of multiple sites, using inherently more complex equipment, or completion of a longer-term project requiring accuracy and dedication.

For Pass standard, learners will consider a minimum of three plant species as appropriate to the sector. They will outline the pests and diseases that may present particular problems in each case, their impacts on the health of the plant or tree, and the likely consequences if control measures are not put in place.

Learners will demonstrate understanding of the basic methods of monitoring levels of pests and diseases, along with their responsibilities under legislation or international equivalents. They will use equipment and resources correctly and safely to demonstrate one organic and one conventional method for preventing and controlling pests and disease. Throughout the practical work, learners will monitor and record the pest and disease status in each case, giving basic and correct details of the features and processes used to identify organisms.

Links to other units

This unit links to:

- Unit 7: Work Experience in the Land-based Sectors
- Unit 27: Identification, Planting and Care of Plants
- Unit 29: Plant Propagation Activities.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research, presentation and communication skills when investigating animal health
- analysis skills when reflecting on a given plant pests and diseases
- independent working practices when protecting or treating plants.

Unit 34: Identification, Planting and Care of Trees

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills needed to plant trees and provide their aftercare, and the knowledge to identify trees using botanical nomenclature.

Unit introduction

Trees are one of the most amazing and diverse range of plants on the Earth, thriving in both urban and rural locations. Tree planting occurs for many reasons, including the management of native woodland, the shaping of the landscape, the production of edible fruit, or simply as ornamental, stand-alone specimens. Being able to correctly identify trees is essential for anyone working in the land-based sector, especially when selecting appropriate trees for planting.

In this unit, you will learn the correct botanical nomenclature and terminology used when identifying trees, as well as the individual characteristics that aid their identification. You will research a range of different trees suitable for a given area and select appropriate trees for planting, using your knowledge of their individual requirements. You will complete practical tasks in planting your chosen trees and providing aftercare so that they establish successfully. Understanding tree requirements and providing suitable surroundings and continued aftercare will mean that your trees will flourish and form a significant feature of the landscape for many years to come.

This unit will give you the skills to identify, plant and care for trees. These skills are a huge advantage for progression to employment in roles such as a greenkeeper, gardener in the grounds of a stately home, or an expert who recommends and sells plants in a garden centre. Alternatively, you may wish to continue your study to higher education, for example countryside management degrees.

Learning aims

In this unit you will:

A Understand botanical nomenclature and terminology for the purpose of tree identification

B Explore factors affecting selection of trees and their suitability for use in a given area

C Undertake planting and aftercare of trees in a given area.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Understand botanical nomenclature and terminology for the purpose of tree identification	**A1** Terminology used in tree nomenclature **A2** Categorisation of trees **A3** Characteristics of trees for identification	A written report on the biological nomenclature and tree characteristics that are used to identify trees, including their effectiveness.
B Explore factors affecting selection of trees and their suitability for use in a given area	**B1** Considerations affecting the choice of trees for specific areas **B2** Factors affecting the suitability of trees	Research notes on the factors that affect the selection and suitability of trees for planting, using findings to select trees to plant in a given area. A portfolio of evidence showing how trees are selected, planting activities and aftercare to ensure trees establish successfully.
C Undertake planting and aftercare of trees in a given area	**C1** Preparation for planting **C2** Planting methods **C3** Providing aftercare	

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Content

Learning aim A: Understand botanical nomenclature and terminology for the purpose of tree identification

Naming conventions and taxonomic categories used to identify trees based on their features, and the importance of using the correct terminology.

A1 Terminology used in tree nomenclature

- Plant classification order for trees:
  - kingdom
  - phyla, including gymnosperms and angiosperms
  - class, including monocotyledons and dicotyledons
  - family
  - genus
  - species
  - sub-species, variety, form, cultivar, hybrid.
- Importance of botanical names:
  - problems that occur using common plant names, including using the native tongue, regional differences, multiple common names for the same genus
  - binominal system for plant naming.
- Correct format for writing plant names:
  - correct use of capital letters, lower case letters, single quotation marks
  - correct use of symbols and abbreviations
  - correct use of descriptive names to aid identification, e.g. pendula, alba, macrophyllum.

A2 Categorisation of trees

Definition, categorisation and identification of trees from native and non-native species:

- broad-leaved trees
- ornamental trees
- evergreen trees
- conifers.

A3 Characteristics of trees for identification

Methods used to identify trees using tree features and characteristics.

- Morphological features and characteristics used in the identification of trees:
  - foliage, including bark, branch, twig, lenticels, node, internode
  - leaf arrangements, including alternate, opposite and whorled, leaf bud, petiolated and sessile
  - veination, including reticulated and parallel, simple and compound
  - leaf types, including cordate, ovate, lanceolate, linear, oblong, palmate, pinnate, trifoliate, lobed, needles, scales
  - leaf colour
  - flowers, including bud, petals, bract, singular, grouped, shape, colour, arrangement
  - succulent fruits, including berries, fruits, drupes
  - dried fruits, including nuts and seeds
  - seasonal features, including stems, foliage, flowers, seeds, fruits.

- Identification methods and tools:
  - tactile features, including smooth, soft, spiked, rough, spongy
  - smell, including fragrant flowers, foliage, sap
  - visual observations, including growth habit, height, spread
  - form, including oval, columnar, rounded, pyramidal, weeping, irregular, vase
  - illustrated textbooks, nursery catalogues, brochures and labels
  - technology, including smartphone apps
  - identification keys, including flow chart, dichotomous key.
- Sources of information and standards for classification, e.g. Forestry Commission, Royal Horticultural Society, the Woodland Trust.

Learning aim B: Explore factors affecting selection of trees and their suitability for use in a given area

Considerations affecting the selection of trees for planting in specific areas.

B1 Considerations affecting the choice of trees for specific areas

Plant requirements:

- preferred soil type, including clay, sand, silt, loam, pH
- nutrient requirements, including primary/macronutrients, secondary nutrients and trace elements for growth, rigour, establishment, flowering and fruiting
- aspect, including light and shade tolerance, space available, frost and sun pockets, protection, topography, air quality
- support needs, including stakes, canes, guards, guys, anchors, ties
- planting stock type, including bare root, root balled, containerised
- specific requirements, including protection and support type for individual trees, including *Quercus*, *Fraxinus*, *Betula*, *Malus*, *Prunus*, *Salix*, *Juglans* and *Fagus*; and for sizes of plant, including seedlings, whip, feathered whip, bush, standard, half-standard, budded/grafted, including maiden, feathered maiden.

B2 Factors affecting the suitability of trees

- Tree growth and habit:
  - size of tree at planting, growth speed, root spread, size, shape and appropriateness of tree for given purpose, including pyramidal, conical, columnar, spreading, rounded, vase shaped, broad.
- Surroundings that affect tree selection:
  - environmental factors, including buildings and structures, overhead and underground services, traffic, highways, climate and microclimate, exposure, drainage, uneven ground, preferred habitat, space
  - public access areas, footpaths, rights of way, potential issues of falling leaves, fruit, overhanging branches, maintenance access
  - aesthetic value, grouping and combinations, arboricultural merit, silvicultural merit
  - soil structure, texture, pH, drainage, nutrient value, depth, including impact on anchorage and support systems.

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Learning aim C: Undertake planting and aftercare of trees in a given area

Consideration when preparing to plant, planting and providing aftercare of trees.

C1 Preparation for planting

- Assessing risk and working safely:
  - identification of hazards and risks around the work area (related to tools, equipment, people) and how these can be minimised, including essential personal protective equipment (PPE)
  - laws/legislation, covering environmental protection, protection of wild flora/fauna, health and safety at work, safe use of chemicals
  - methods for working safely and minimising damage to working areas.
- Use and application of correct tools, materials and equipment to prepare ground for planting:
  - tools, including spade, rake, hoe, trowel, wheelbarrow
  - materials, including stakes, ties, guards, soil conditioners, organic matter, fertiliser base dressing
  - machinery, including cultivator, rotavator, excavator.
- Ground preparation:
  - cultivation by hand or machine, including correct depth, consolidation, level, addition of soil conditioners, ameliorants, fertilisers, anti-desiccants, as appropriate to area
  - removal of debris, weeds, organic and inorganic waste before planting and correct disposal.

C2 Planting methods

Activities undertaken to ensure optimum condition for planting and successful establishment.

- Use and application of correct tools and equipment for planting:
  - tools, including spades, e.g. Schlick, Mansfield, rake, hoe, trowel, secateurs, loppers, wheelbarrow
  - machinery, including hydraulic tree spades, rotary planters, augers.
- Tree preparation, including watering, removal of dead foliage and weeds, pruning.
- Planting:
  - safe working practices to minimise damage to working area and self
  - reviewing ground preparation
  - handling of trees to avoid damage
  - backfilling
  - safe disposal of waste, including organic and inorganic
  - safe removal of tools and equipment.

C3 Providing aftercare

Methods, equipment and materials used for successful establishment and growth.

- Tree protection, including support, e.g. stakes, guys, anchors and guards for protection from animals, people and weather.
- Initial aftercare to ensure successful establishment, including feeding, watering, pruning, mulching with organic and inorganic materials, disposal of waste, including organic and inorganic.
- Continued aftercare, including inspection, nutrition, watering, formative pruning, moisture retention, mulching, adjustment and removal of support, use of pesticides and herbicides.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand botanical nomenclature and terminology for the purpose of tree identification		**A.D1** Evaluate the effectiveness of botanical nomenclature and characteristics in aiding tree identification.
A.P1 Explain the botanical nomenclature and terminology used to identify trees. **A.P2** Explain plant classification and different characteristics that aid identification.	**A.M1** Assess how botanical nomenclature and characteristics aid tree identification.	
Learning aim B: Explore factors affecting selection of trees and their suitability for use in a given area		**B.D2** Evaluate own selection of trees based on factors that affect selection and suitability for a given area.
B.P3 Explain the factors that affect the selection of trees in a given area. **B.P4** Explain own selection of trees for a given area.	**B.M2** Analyse factors for own selection of trees for a given area.	
Learning aim C: Undertake planting and aftercare of trees in a given area		**C.D3** Evaluate methods used to carry out planting and aftercare, with recommendations for future improvements.
C.P5 Demonstrate safe working practices when carrying out ground preparation, planting and aftercare to establish new trees. **C.P6** Explain methods used to carry out planting and aftercare of trees.	**C.M3** Demonstrate efficient working practices when preparing, planting and providing aftercare to establish new trees. **C.M4** Analyse the impact of own methods used to carry out planting and aftercare.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, C.M4, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of trees to study, from young whips to mature trees
- an area to plant and establish new trees
- appropriate, well-maintained tools, equipment and materials for preparing ground, planting and providing aftercare to trees
- suitable PPE.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will provide a thorough and detailed account of the effectiveness of biological nomenclature and physical plant characteristics when identifying trees. They will show depth of understanding by making detailed links between their use and tree identification, using well-selected, accurate examples of how this leads to positive identification. Learners will provide detailed reasoning as to the limitations of using descriptive biological nomenclature and characteristics to identify trees, using well-selected examples of negative identification.

Learners will consider identification methods and tools thoroughly, recommending those that lead to positive identification.

For Merit standard, learners will examine the effectiveness of biological nomenclature and characteristics when identifying trees. They will demonstrate their understanding by making clear links between their use and tree identification, using appropriate examples of how this leads to positive identification. Learners will demonstrate awareness of the limitations of these methods to identify trees and support this through the use of examples and an explanation of some of the issues.

Learners will provide a clear understanding of identification methods and tools, and provide clear reasoning as to the link between the methods and positive identification.

For Pass standard, learners will demonstrate clear understanding of the approach used in botanical nomenclature and the methods used to obtain a positive identification of trees using physical characteristics. Learners will demonstrate some awareness that there are limitations to their use.

Learners will provide details of a number of identification methods and tools, and the main reasons they may be selected for use.

Learning aims B and C

The assessment requires a given area to carry out the selection, preparation, planting and aftercare of trees.

For Distinction standard, learners will demonstrate clear and detailed reasoning for their tree selection through a thorough examination of the given planting area, considering all relevant aspects that may affect successful tree establishment. This will include full details on the tree requirements for successful growth, meticulously linked to the site conditions. Learners will consider their choices carefully and fully justify their selection in relation to factors affecting suitability.

Learners will carry out planting and aftercare that is effective in supporting the successful establishment of their chosen trees. Learners will evidence clear ways to minimise risks and fully demonstrate competent safe working practices throughout. They will select correct tools, materials and equipment, using them safely and to industry standard. They will draw on knowledge from their learning to reflect on the decisions they made when planting and undertaking practical tasks. Efficient care will be given to the tree throughout the planting and aftercare processes.

Learners will show a comprehensive understanding of tree requirements before planting, during planting and when providing aftercare to support the successful establishment of trees. Learners will review the methods they used for planting and aftercare to thoroughly explore where they were successful and where methods could be improved or carried out differently.

For Merit standard, learners will provide evidence that they have researched different trees and tree types to select trees for planting that clearly match the site conditions and the likelihood of successful establishment. Learners will review their selection of trees, presenting well-documented evidence and making reasoned recommendations for their selection, providing clear links between the features of the given planting site and the selected trees.

Learners will carry out planting, showing they have optimised the given area through the preparation of the site and trees, planting with skill, and by demonstrating efficiency in the time taken, the resources used and the minimal disruption to the trees during the planting process. Learners will draw on their knowledge to consider ground conditions and prepare the area appropriately. They will assess the hazards and risks involved in carrying out the practical tasks and use the required tools, materials and equipment safely and competently.

Learners will show detailed knowledge of individual tree requirements in order to provide aftercare that helps to support successful establishment, for example providing tree stakes, ties and protection that match the age of the tree planted.

Learners will reflect on the methods they used and make clear connections to their impact on the successful establishment of trees.

For Pass standard, learners will provide details of the features and characteristics of a given area and research a range of suitable trees for the area, demonstrating an understanding of different tree types, requirements and any limiting factors of the area to be planted. Learners will select a range of trees from those researched, making links between site characteristics and tree requirements.

Learners will work safely, with an awareness of the risks and potential issues arising when preparing the ground for planting trees, during the planting process, and when providing aftercare. Learners will use appropriate methods, tools and equipment to prepare and plant their selected trees, leaving the area clean and tidy on completion. Learners will provide basic aftercare for trees, which may include tree guards or support. On completion of the tasks, learners will safely remove and store tools, materials and equipment, disposing of waste materials appropriately.

Learners will provide reasons for their selected methods for tree planting and aftercare, demonstrating some understanding of the impact these methods have on the successful establishment of trees.

Links to other units

This unit links to *Unit 7: Work Experience in the Land-based Sectors.*

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills when investigating tree requirements for different areas
- personal skills when working with others
- self-management skills when carrying out tree establishment techniques.

Unit 35: Participating in Horticultural Tasks at Events

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners investigate horticultural roles and tasks for events, carrying out practical horticultural tasks and reviewing their performance in carrying out the tasks as part of an event.

Unit introduction

There is a growing number of events relevant to the horticulture sector, presenting opportunities to showcase a variety of horticultural skills. Events include open gardens, ticketed horticultural shows, community events, fetes, plant society shows, country fairs and workshops. These events require dedicated teams of horticulturalists to work together, from planning through to the breakdown of events, with individual roles being clearly defined in a team. The way that individuals work in teams to achieve specific goals with their skillset is vital to a successful event.

In this unit, you will develop your knowledge and understanding of the roles most commonly available in events associated with the horticulture sector. You will investigate how these specialist roles work in a team, and the importance of communication and effective methods of working. This will help you develop the skills required to work in an individual role as part of a horticultural team at an event. In completing the assessment tasks for this unit, you will select and apply your knowledge and skills from the following units: *Unit 7: Work Experience in the Land-based Sectors*, *Unit 27: Identification, Planting and Care of Plants* and *Unit 28: Routine Plant Management*.

This unit will help you to develop your skills further in working as part of a horticultural team at an event, and to progress directly to employment in the horticulture sector. The unit will also help to prepare you for progression to further or higher education in horticulture.

Learning aims

In this unit you will:

A Investigate horticultural roles and tasks associated with events

B Carry out horticultural tasks at an event to meet the requirements of a specific job role

C Review own performance in carrying out horticultural tasks at an event.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate horticultural roles and tasks associated with events	**A1** Different types of horticultural role associated with events **A2** Understanding remit of own role in the event, in order to carry out tasks effectively **A3** Using appropriate methods to plan own horticultural tasks at an event	Learners produce a plan to carry out role-specific duties and tasks as part of a horticultural project at an event, evaluating the impact of a horticultural role associated with events.
B Carry out horticultural tasks at an event to meet the requirements of a specific job role	**B1** Specific health and safety considerations for the horticultural tasks to be carried out **B2** Working with others to carry out horticultural tasks at an event **B3** Carrying out horticultural tasks at an event	Learners provide evidence of carrying out the planned horticultural tasks, evaluating the importance of health and safety.
C Review own performance in carrying out horticultural tasks at an event	**C1** Reviewing effectiveness of own performance **C2** Identifying potential areas for improvement **C3** Skills development	Learners produce an evaluation of their own performance in carrying out the planned horticultural tasks, including a personal skills development plan.

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Content

Learning aim A: Investigate horticultural roles and tasks associated with events

A1 Different types of horticultural role associated with events

- Hard landscaper for paving, bricklaying, fencing and structural work.
- Garden designer for designing initial designs according to a brief, adapting and ensuring the design brief is achieved.
- Project manager and deputy project manager for leading, planning and monitoring the implementation of designs.
- Gardeners for general horticultural tasks, e.g. selecting, storing, preparing, planting, moving plants.
- Nursery workers who specialise in growing and preparing plants for events.
- Event sponsors and promoters.

A2 Understanding remit of own role in the event in order to carry out tasks effectively

- Understanding different roles and responsibilities in a team so that communication is effective.
- Clarifying own individual role in the team, e.g. general tasks and duties, expectations from team leader or manager.
- Specific tasks required of an individual.
- Setting out the extent and limit of role and responsibilities clearly, agreeing them in advance of the event, knowing how own role relates to the roles of others.
- Importance of following agreed plan for an event, e.g. timings, procedures and protocols, when to escalate a matter or ask for help.
- Reporting incidents and accidents.

A3 Using appropriate methods to plan own horticultural tasks at an event

- Setting individual, role-specific objectives for what needs to be achieved:
  - specific horticultural tasks, e.g. preparing plants, monitoring plants for readiness, ordering resources and meeting deadlines
  - non-horticultural specific tasks, e.g. compiling meeting notes, recording income or expenditure.
- Creating and using checklists for individual use.
- Plant selection and plant care, e.g. growing, cultivating and maintaining healthy plants.
- Interpreting relevant aspects of designs and plans in order to carry out role-specific, individual tasks, e.g. required health and safety checks, plant selection, checking soil and other environmental conditions, management and storage of equipment and machinery, preparation and planting of plants, protection and maintenance of plants for the event, waste disposal, interaction with event visitors, providing horticultural advice or information.
- Importance of having clear plans for set-up phase, during the event and dismantling after the event.

Learning aim B: Carry out horticultural tasks at an event to meet the requirements of a specific job role

B1 Specific health and safety considerations for the horticultural tasks to be carried out

- Risk assessments and safety checks of premises/event sites and equipment.
- Personal protective equipment (PPE) needed for horticultural tasks and participating safely in an event across the different job roles.
- Provision of signage and information for visitors/staff on event site.
- Using standard operating procedures, ensuring they are available and accessible for those using equipment and machinery.
- Manual handling procedures for loading and unloading vehicles and/or moving materials and plants.
- Working at height or in close proximity to caned or staked plants.
- Disposing of waste legally and in line with sustainable practices.

B2 Working with others to carry out horticultural tasks at an event

- How different roles and interpersonal skills make groups or teams effective.
- Agreeing suitable working arrangements by deciding on ways of keeping others informed of progress, agreeing where you will work.
- Knowing where to get resources and help needed to carry out own tasks, including materials, equipment, support from colleagues.
- Checking own progress, asking for support or escalating issues as appropriate, resolving conflicts to improve efficiency, motivating others.
- Sharing constructive feedback in order to assess how successful the work has been and to improve motivation of self and others.

B3 Carrying out horticultural tasks at an event

- Preparing resources for use, including tools, plant stock, construction materials, equipment, machinery and people.
- Participating in event tasks:
    - plant selection and maintenance
    - loading and unloading vehicles safely, using materials and equipment safely
    - following instructions to meet a design or event brief
    - correctly identifying own tasks and remit within a team
    - participating effectively in the event team, communicating and interacting appropriately with others
    - using problem-solving skills to assess issues, examine alternatives, decide on a course of action, implement solutions and monitor outcomes
    - completing tasks in a timely way to meet design/event requirements and team expectations
    - maintaining resources, e.g. plants, construction materials, equipment and tools before, during and after an event.

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Learning aim C: Review own performance in carrying out horticultural tasks at an event

C1 Reviewing effectiveness of own performance

- Definition of review, e.g. thinking about what we are doing as we do it and when finished; plan, do, review cycle.
- Defining the skill or quality that is being reviewed.
- Review methods, such as:
  - question-based, e.g. How well did I do that task? How can I do it better next time?
  - open reflection, e.g. group discussions, sharing ideas
  - reflective log, e.g. recording short comments in a log on a regular basis
  - work environment reviews, e.g. performance reviews, 'lessons learned' meetings at end of project
  - evaluation forms, e.g. after the event
  - images and video review of the event
  - feedback from event teams.
- Creating an evaluation framework to assess own performance, e.g.:
  - review past performance, measure against work-based standards, completing tasks and achieving goals, positive feedback, sense of achievement and satisfaction.

C2 Identifying potential areas for improvement

- Individual reflection on own performance and skills, including interpersonal skills.
- Using feedback from others to improve the quality of individual work in the future and improving ways of working with others.

C3 Skills development

Developing individual skills identified from the review and reflection stage.

- Considering how carrying out the horticultural tasks has contributed to the development of key competencies needed for employability, e.g. teamwork, problem solving, communication skills.
- Identifying strongest skills and skills requiring improvement.
- Skills development plan for an individual, including:
  - skills requiring improvement and skills gaps
  - resources, support or training needed
  - how to action goals and set realistic timescales
  - how to measure the success of the plan.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate horticultural roles and tasks associated with events		**A.D1** Produce a comprehensive plan for own horticultural tasks at an event, evaluating the impact of a horticultural role associated with events.
A.P1 Explain the significance of a horticultural role associated with events. **A.P2** Produce a plan for own role-specific horticultural tasks at an event.	**A.M1** Analyse the significance of a horticultural role associated with events, using a detailed horticultural task plan produced for own specific role.	
Learning aim B: Carry out horticultural tasks at an event to meet the requirements of a specific job role		**B.D2** Work with others to carry out horticultural tasks at an event with a high degree of accuracy, evaluating the importance of health and safety.
B.P3 Explain health and safety considerations for horticultural tasks to be carried out at an event. **B.P4** Work with others to carry out horticultural tasks competently at an event.	**B.M2** Work with others to carry out horticultural tasks efficiently at an event, analysing the importance of health and safety.	
Learning aim C: Review own performance in carrying out horticultural tasks at an event		**C.D3** Evaluate own performance in carrying out horticultural tasks at an event to produce a comprehensive personal development plan.
C.P5 Explain own effectiveness in carrying out horticultural tasks at an event. **C.P6** Produce a basic personal development plan.	**C.M3** Analyse own performance in carrying out horticultural tasks at an event to produce a detailed personal development plan.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- an event (this could be held at the centre with a local community organisation, employer or other relevant organisation) to provide a venue for holding a horticultural activity
- input from those working in the events industry or a related field, such as a secretary of a local horticultural society, information event organiser at a centre or garden design consultant.

Essential information for assessment decisions

Learning aims A and B

In achieving learning aims A and B, learners must individually plan and carry out horticultural tasks in an event context. In completing the assessment tasks for these learning aims, learners must select and apply knowledge and skills from their learning across the mandatory units. They will be expected to make connections between their planning and execution of tasks in this unit, and the assessment already completed for *Unit 1: Plant and Soil Science*, *Unit 7: Work Experience in the Land-based Sectors*, *Unit 27: Identification, Planting and Care of Plants* and *Unit 28: Routine Plant Management*. In particular, learners will be expected to show the selection and application of knowledge and skills from their learning across the mandatory units in the following areas: health, safety and legislative requirements; planning and recording of work; selection, care and management of plants and the use of machinery or equipment.

The completion of the assessment tasks for learning aims A and B in this unit will underpin the completion of the assessment for learning aim C in *Unit 36: Resource and Operations Planning for Event-based Horticultural Activities*.

Teachers should ensure that the horticultural tasks and roles chosen by learners provide sufficient scope for them to fully complete the assessment.

For Distinction standard, learners will show breadth and depth in the application of knowledge of a specific horticultural role associated with event tasks. They will clearly justify one pivotal horticultural role required for a relevant event, showing comprehensive understanding of the nature and scope of the role.

Learners will demonstrate consistently well-reasoned use of appropriate methods to plan their own individual horticultural tasks for an event, including a thorough and methodical approach to event operations that affect their own role. They will demonstrate that they understand and can set individual, role-specific objectives for what they need to achieve before, during and after an event. They will create and use effective task checklists for their own individual use, having a meticulous approach to required actions such as interpreting a design and having comprehensive, logical plans for setting up the tasks, carrying out the tasks during the event and post-event dismantling. Learners will produce comprehensive, role-specific operational checklists and plans for their own individual tasks. These will include timescales and resources that are consistently relevant to the horticultural element of an event.

Learners will show a high degree of initiative in carrying out their role-specific tasks as an individual in a horticultural team for an event, demonstrating a robust understanding and skills in the application of specific health and safety considerations for their tasks to be carried out. They will show an ability to work effectively with others to achieve the aims of their assigned tasks. Learners will use appropriate terminology consistently and accurately throughout, showing breadth and depth of understanding. They will demonstrate consistent and accurate selection and application of their knowledge of plant care and management and use of machinery or equipment from the assessment completed in *Unit 7: Work Experience in the Land-based Sectors*. Learners will show skills in identifying, selecting and care of plants used in events, applying skills from *Unit 27: Identification, Planting and Care of Plants* and *Unit 28: Routine Plant Management*. They will consistently show that they have accurately selected and applied knowledge and skills relating to professional responsibilities, health and safety legislation and safe working practices from the assessment completed in *Unit 1: Plant and Soil Science*.

For Merit standard, learners will show a detailed understanding of a specific horticultural role associated with event tasks. They will analyse one pivotal role required for a relevant event, and will make mostly relevant references to the nature and scope of the role.

Learners will demonstrate a generally well-reasoned use of appropriate methods to plan their own individual horticultural tasks for an event. This will include a logical, clear approach to event operations that affect their own role but may lack specific justification for actions. Learners will demonstrate that they understand and can set individual, role-specific objectives for what they need to achieve before, during and after an event. They will effectively create and use task checklists for their own individual use, have a generally reasoned approach to required actions such as interpreting a design, and will have clear plans for setting up, during the event and post-event dismantling. Learners will produce detailed, role-specific operational checklists and plans for their own individual tasks. This will include timescales and resources that are relevant to the horticultural element of an event. These may contain some unrealistic timescales and resources.

Learners will show some initiative in carrying out their role-specific tasks as an individual in a horticultural team for an event, demonstrating appropriate understanding and skills in the application of specific health and safety considerations for their tasks to be carried out. Learners will use appropriate terminology accurately, showing some breadth and depth of understanding. They will give mostly valid justification for actions and decisions taken. They will show an ability to work appropriately with others to achieve the aims of their assigned tasks.

Learners will demonstrate a clear and mostly relevant selection and application of their knowledge of plant care and management and use of machinery or equipment from the assessment completed in *Unit 7: Work Experience in the Land-based Sectors*. Learners will show skills in identifying, selecting and care of plants used in events, applying skills from *Unit 27: Identification, Planting and Care of Plants* and *Unit 28: Routine Plant Management*. They will show a clear and mostly relevant selection and application of knowledge and skills relating to professional responsibilities, health and safety legislation and safe working practices from the assessment completed in *Unit 1: Plant and Soil Science*.

For Pass standard, learners will show some realistic understanding of a specific horticultural role associated with events. They will explain one pivotal role required for a relevant event and will make limited references to the nature and scope of the role.

Learners will show limited use of appropriate methods to plan their own individual horticultural tasks for an event. They will demonstrate a realistic approach to event operations that affect their own role but will generally lack justification and clarity for actions. Learners will demonstrate that they understand and can set individual, role-specific objectives for what they need to achieve before, during and after the event. They will create and use realistic task checklists for their own individual use, having a limited level of reasoning regarding required actions such as interpreting a design, and having basic but realistic plans for setup, during the event and post-event dismantling. Learners will produce role-specific operational checklists and plans for their own tasks that include timescales and resources that are relevant to the horticultural element of an event. These may have unrealistic timescales and/or resources, and will lack breadth and depth.

Learners may show little initiative in carrying out their role-specific tasks as an individual in a horticultural team for an event, demonstrating limited but realistic understanding and skills in the application of specific health and safety considerations for their tasks to be carried out. Learners will use basic terminology throughout, with limited justification for actions and decisions and some inaccuracies in their technical approach. They will show some ability to work appropriately with others to achieve the aims of their assigned tasks.

Learners will demonstrate some relevant selection and application of their knowledge of plant care and management and use of machinery or equipment from the assessment completed in *Unit 7: Work Experience in the Land-based Sectors*. Learners will show skills in identifying, selecting and care of plants used in events, applying skills from *Unit 27: Identification, Planting and Care of Plants* and *Unit 28: Routine Plant Management*. They will show some relevant selection and application of knowledge and skills relating to professional responsibilities, health and safety legislation and safe working practices from the assessment completed in *Unit 1: Plant and Soil Science*.

Learning aim C

For Distinction standard, learners will give a well-reasoned and fully justified explanation of their own performance during and following an event in which they participated fully. Learners will show breadth and depth of understanding of their individual role over the whole event, making insightful references to all aspects of their allocated role. Learners' reviews and reflections will demonstrate a logical approach to measuring the success of their performance against set objectives, identifying individual potential areas for improvement.

Learners will give a comprehensive explanation of the purpose of receiving feedback and reviewing their own performance, both individually and as part of a team. Learners will produce a well-developed, comprehensive skills development plan covering strengths and showing the skills required to improve performance in the future. Learners will use appropriate terminology consistently and accurately throughout, showing breadth and depth in their review.

For Merit standard, learners will give a mainly well-reasoned explanation of their own performance during and following an event in which they participated fully. They will show breadth and some depth of understanding of their role over the whole event, making reference to most key aspects of their allocated role.

Learners' reviews and reflections will demonstrate an appropriate, clear approach to measuring the success of their performance against set objectives, identifying generally valid individual potential areas for improvement. They will give a detailed, clear explanation of the purpose of receiving feedback and reviewing their own performance, both individually and as part of a team. Learners will produce an appropriate skills development plan that is mostly relevant and covers some of the strengths and skills required to improve performance in the future. The plan may lack depth in some areas, with some references generalised to generic skills rather than specific role skills. Learners will use appropriate terminology accurately showing some breadth and depth. They will provide clear justification for actions and decisions although there may be some minor inaccuracies in their approach.

For Pass standard, learners will give an undeveloped explanation and some examples of their own performance during and following an event in which they participated fully. Learners will show limited breadth and depth of understanding of their role over the whole event. They will refer to most aspects of their allocated role.

Learners' reviews and reflections will demonstrate a basic approach to measuring the success of their performance with some links to set objectives, identifying limited individual potential areas for improvement. They will give a general but realistic explanation of the purpose of receiving feedback and of reviewing their own performance, both individually and as part of a team. Learners will produce a realistic but undeveloped skills development plan. The plan will make some relevant references to the strengths and skills required to improve performance in the future. This will lack depth and balance, and may be appropriate to generic skills rather than specific role skills. Learners will use basic terminology throughout. Learners will give some justification for actions and decisions and there may be some inaccuracies in their technical approach.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 7: Work Experience in the Land-based Sectors
- Unit 27: Identification, Planting and Care of Plants
- Unit 28: Routine Plant Management
- Unit 29: Plant Propagation Activities
- Unit 33: Pests and Disease in Plants.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops
- masterclasses with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills
- presentation and interpersonal skills when working with others
- analytical and evaluative practices when carrying out horticultural tasks
- mathematical skills and knowledge when calculating costs.

Unit 36: Resource and Operations Planning for Event-based Horticultural Activities

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners investigate events relevant to the horticulture sector and carry out planning for a horticultural activity as part of an event.

Unit introduction

In this unit, you will develop important skills and knowledge in planning horticultural activities for an event. Horticulture events take place frequently and are one of the most exciting and dynamic aspects of the sector. Examples of events range from meetings, product launches, exhibitions, flower shows, gardening talks, promotions and charity events, to society meetings, harvest festivals, craft fairs and country shows. There are also other events that have a horticultural aspect to them.

In this unit, you will investigate what makes the horticultural element of an event successful. You will use your research to develop a horticultural plan for an event. This will develop your skills in teamwork, communication, time management, negotiation and problem solving. These are all essential transferable skills valued by employers. You will consider the stages of planning horticultural activities for an event, including planning the use of resources, people and finances, and how to measure the feasibility of the horticultural plan. This builds on the tasks carried out in *Unit 35: Participating in Horticultural Tasks at Events*, and it is expected that you will select and apply learning from the content of that unit. You will also draw on the skills and knowledge developed in *Unit 27: Identification, Planting and Care of Plants* and *Unit 28: Routine Plant Management.* You will use your experience of real working practices in the sector that you gained in *Unit 7: Work Experience in the Land-based Sectors*.

This unit will help you to develop your skills further in planning the horticultural aspects of events, and progress directly to employment in the horticulture sector. The unit will also help prepare you for progression to further or higher education in horticulture or business.

Learning aims

In this unit you will:

A Investigate the range and impact of different types of event relevant to the horticulture sector

B Investigate the planning requirements for a horticultural activity at an event

C Produce a horticultural plan for an event to meet a given brief.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the range and impact of different types of event relevant to the horticulture sector	**A1** Types of event relevant to the horticulture sector **A2** Potential benefits and challenges associated with events relevant to the horticulture sector **A3** Factors affecting the success of the horticultural element of an event	Learners produce a report or presentation on: • the impact of different types of event relevant to the horticulture sector • the factors affecting the success of the horticultural aspect of an event • the key aspects of planning, resources and health and safety requirements for the horticultural element of an event.
B Investigate the planning requirements for a horticultural activity at an event	**B1** Planning methods for a horticultural activity for an event **B2** Resource and logistical requirements for a horticultural activity at an event **B3** Health and safety requirements associated with a horticultural activity at an event	
C Produce a horticultural plan for an event to meet a given brief	**C1** Key components of the horticultural plan for an event **C2** Producing efficient financial costings for the horticultural element of an event **C3** Reviewing the effectiveness of the horticultural plan in meeting a given brief	Learners produce a horticultural plan to be used as part of an event, evaluating the effectiveness of the plan in meeting a given brief.

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Content

Learning aim A: Investigate the range and impact of different types of event relevant to the horticulture sector

A1 Types of event relevant to the horticulture sector

- Different categories and sizes of event, e.g. public, private, single events, held over several days, on single sites, held on several sites sequentially and concurrently, non-ticketed, ticketed, open events.
- Specialist horticultural events, e.g. trade shows, local growing competitions, national flower and gardening shows, production horticulture conferences and meetings, local community groups, professional association events such as horticultural societies, landscape shows, home and garden national exhibitions, plant trial events.
- Events that have a horticultural element, e.g. events at stately homes, home and interior events, village fetes, agricultural events.
- The role of events in highlighting links between horticulture and other industries, e.g. security, hospitality, automotive, logistics, customer service, construction, graphic design, media, tourism, marketing, IT, communications.

A2 Potential benefits and challenges associated with events relevant to the horticulture sector

- General economic benefits of events, e.g. income, contribution to national and regional economies, tourism, retail sales, employment opportunities.
- General social benefits of events, e.g. health and wellbeing, community cohesion, promoting care of the environment, promoting 'grow your own' schemes.
- Specific benefits for the horticulture sector of events, e.g. raising the profile of key horticultural stakeholders and awareness of key horticultural issues, educating and advising the public, raising funds for horticultural research and conservation projects, potential skills development for those involved in planning and running event activities.
- Challenges associated with events, e.g. adverse weather, budget constraints, poor attendance, managing plant timings for flowering, growing plants under glass out of season, storing and transporting large volumes of plants, damaged plants, unavailability of resources.

A3 Factors affecting the success of the horticultural element of an event

- General event factors that could affect the success of the horticultural element, including:
  - location and accessibility
  - attendance and footfall
  - other attractions or activities at the event
  - marketing, media and social media coverage.

- Horticultural factors that could affect the success of the horticultural element, including:
  - plant quality and readiness for events
  - quality of work on show, awards and accolades
  - relevance to current trends in horticulture
  - achieving design or event brief
  - meeting deadlines
  - amount of funding or sponsorship and any conditions attached
  - environmental impact of the horticultural activities, e.g. recycling and waste management, enhancement of the environment.

Learning aim B: Investigate the planning requirements for a horticultural activity at an event

B1 Planning methods for a horticultural activity for an event

- Planning and implementation cycle for a horticultural activity, including:
  - identifying aims of the event activity
  - researching and identifying means of delivering the event activity aims
  - preparing a detailed plan to achieve aims
  - evaluating feasibility of the event activity plan
  - implementing the event activity plan
  - evaluating success of the event activity.
- Use of appropriate planning documents, including:
  - risk assessments
  - checklists for the activity
  - appropriate documents to record financial information, e.g. projected spend and actual spend, setting out headings for each financial aspect of the horticultural activities.
- Propagation, cultivation and sourcing of plant stock.
- Allocating roles to people and recording role allocation, e.g. growing plants, sourcing resources.

B2 Resource and logistical requirements for a horticultural activity at an event

- Types of resource and their uses for a horticultural activity at an event, including:
  - plant stock, e.g. propagation and cultivation of plants in readiness for event
  - staff who have appropriate skills and competencies
  - appropriate event space and facilities
  - construction materials, e.g. timber, masonry, hardware and metal
  - tools, machinery, equipment and personal protective equipment (PPE).
- Logistical requirements:
  - methods and requirements for transporting resources, including plants, specimen plants, construction materials
  - delivery logistics, including importance of timing and schedules
  - storage and protection of plant stock, construction materials and other event resources
  - preparation of site for event, e.g. stalls, stands, displays, design briefing.

B3 Health and safety requirements associated with a horticultural activity at an event

- Risk assessments and safety checks for horticultural activities, e.g. planting, moving and working with construction materials.
- Personal protective equipment (PPE) for horticultural tasks and participation in horticultural activities across different job roles, e.g. eye protection when using canes and ties, ear protection when using machinery, gloves to protect hands.
- Use of signage and information for visitors and staff on the event site.
- Using standard operating procedures and ensuring they are available for equipment use, e.g. mowers, power tools, hedge cutters.
- Manual handling procedures for loading and unloading vehicles, moving materials and plants.
- Procedures for working at height.

Learning aim C: Produce a horticultural plan for an event to meet a given brief

C1 Key components of the horticultural plan for an event

- Goals, objectives, critical success factors.
- Showing how the horticultural aspect of an event fits in with the overall venue design.
- Infrastructure, equipment and services:
  - selection of contractors and sub contractors
  - planning and construction/set up of the area and/or infrastructure to be used for the horticultural activity in the event
  - delivery and installation of equipment and services to be used for the horticultural activity at the event
  - safe removal of equipment and services for the horticultural activity
  - dismantling the infrastructure.
- Selection and care of plant stock.
- Effective visitor management strategies.
- Procedures for dealing with fire, first aid, contingencies and major incidents.
- Managing rubbish, waste-water disposal and organic waste in line with sustainable practices.
- Communication methods.
- Skills types required and specific roles for a successful horticultural activity, allocating people to different aspects of the plan.
- Allocating resources, e.g. plants, compost, construction materials, ornamental features.
- Financial costings.

C2 Producing efficient financial costings for the horticultural element of an event

- Horticultural budget, including costing for resources used in the event.
- Monitoring and managing the budget, including financial contingencies and actions if overspend occurs, focusing on resources, attendance and entry costs.
- Allocating financial resources: allocating and managing budgets in line with the horticultural plan, including breakdown of different areas of income and spending.

C3 Reviewing the effectiveness of the horticultural plan in meeting a given brief

- Collecting any relevant feedback on the plan, e.g. from judges or experts.
- Reviewing feedback collected and drawing conclusions against original plan or any other relevant criteria, e.g.:
  - extent to which the specific aims of the horticultural activities are met in the horticultural plan, e.g. educating and advising the public, promoting sustainable horticultural practices, selling products, generating income for research and conservation, generating income for a commercial organisation or charity
  - extent to which proposed plan could be achieved within set budget
  - SWOT (strengths, weaknesses, opportunities, threats) analysis
  - suggesting improvements and further development.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate the range and impact of different types of event relevant to the horticulture sector		**A.D1** Evaluate the impact of different types of event relevant to the horticulture sector, and the factors affecting the success of the horticultural element of one type of event.
A.P1 Explain the impact different types of event relevant to the horticulture sector. **A.P2** Compare the key factors affecting the success of the horticultural element of one type of event.	**A.M1** Analyse the impact of different types of event relevant to the horticulture sector, and the factors affecting the success of the horticultural element of one type of event.	
Learning aim B: Investigate the planning requirements for a horticultural activity at an event		**B.D2** Evaluate the key aspects of planning, resource, logistical and health and safety requirements for the horticultural element of an event.
B.P3 Explain the key aspects to consider when planning a horticultural element for an event. **B.P4** Explain the importance of resource, logistical and health and safety considerations for the horticultural element of an event.	**B.M2** Analyse the key aspects of planning, resource, logistical and health and safety requirements for the horticultural element of an event.	
Learning aim C: Produce a horticultural plan for an event to meet a given brief		**C.D3** Produce a comprehensive horticultural plan for an event, evaluating the effectiveness of the plan in meeting a given brief.
C.P5 Produce a basic horticultural plan for an event to meet a given brief. **C.P6** Review the extent to which the horticultural plan meets a given brief.	**C.M3** Produce a detailed horticultural plan for an event, justifying choices made in developing the plan to meet a given brief.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a visit to an event with a horticultural element (this could be held at the centre with a local community organisation, employer or other relevant organisation)
- input from those working in the events industry or a related field, such as a secretary of a local horticultural society, information event organiser at a centre or garden design consultant.

Essential information for assessment decisions

Learning aims A and B

For Distinction standard, learners will show a comprehensive understanding of the types of event relevant to the horticulture sector, selecting two different events. They will give consistently valid, in-depth justifications of the variety of factors that can affect the success of the horticultural element of one type of event, referring logically to those listed in the unit content and any other relevant factors appropriate to their chosen event. They will also give an in-depth account of the general economic and social impact of relevant events and also of the specific impact for the horticulture sector, supported by consistently valid, well-developed justifications.

Learners will show a comprehensive knowledge and understanding of all the key factors to be considered in planning the horticultural aspect of an event. They will demonstrate a consistently accurate application of knowledge and skills from the assessment completed in *Unit 35: Participating in Horticultural Tasks at Events*, by giving specific, insightful explanations of the planning and implementation requirements for events. They will fully consider the legal aspects, resource and logistical requirements and health and safety requirements needed for planning successful horticultural event activities. Learners will show breadth and depth in their knowledge and understanding with robust justifications that link logically to their views. They will use appropriate terminology consistently and accurately throughout.

For Merit standard, learners will show a clear understanding of the types of event relevant to the horticulture sector, selecting two different events. They will show breadth and some depth of understanding of the variety of factors that can affect the success of the horticultural element of one type of event, making mostly relevant references to those listed in the unit content and any other factors appropriate to their chosen event. They will also give a clear analysis of the general economic and social impact of relevant events and of the specific impact for the horticulture sector, providing mostly relevant justifications for their views.

Learners will show a detailed understanding of most of the key factors to be considered in planning the horticultural aspect of an event. They will demonstrate a clear and mostly relevant application of their knowledge and skills from the assessment completed in *Unit 35: Participating in Horticultural Tasks at Events* by giving clearly defined explanations of the planning and implementation requirements for events. They will consider the legal aspects, resource and logistical requirements and health and safety requirements needed for planning successful horticultural event activities. Their analysis will be mostly accurate and realistic. Learners will show some breadth and depth in their knowledge and understanding, giving generally relevant reasons for their views. They will use appropriate terminology accurately.

For Pass standard, learners will show a realistic but undeveloped understanding of the types of event relevant to the horticulture sector, selecting two different events. They will show limited understanding of the variety of factors that can affect the success of the horticultural element of one event type, making some relevant references to those listed in the unit content and any other factors appropriate to their chosen event. They will give an appropriate, realistic explanation of the general economic and social impact of relevant events but this will be limited in scope. Learners will show some realistic understanding of the impact of events on the horticulture sector, with some limited or generic reasons provided for their views.

Learners will show an appropriate but undeveloped understanding of most of the key factors to be considered in planning the horticultural aspect of an event. The evidence will be realistic but will lack accuracy and clarity in parts.

Learners will show a limited application of their knowledge and skills from the assessment completed in *Unit 35: Participating in Horticultural Tasks at Events* by giving basic explanations of the planning and implementation requirements for events. They will show some relevant consideration of the legal aspects, resource and logistical requirements and health and safety requirements needed for planning successful horticultural event activities. They will give undeveloped or generic explanations of key considerations, showing limited breadth and depth in their knowledge and understanding. Learners will use basic terminology with some accuracy.

Learning aim C

Learners must individually prepare and produce their own plan for the horticultural component of an event. They should build on and make connections between their plan in this unit and the assessment tasks related to the planning and execution of individual event tasks completed in *Unit 35: Participating in Horticultural Tasks at Events*. Teachers should ensure that the horticultural component of an event chosen by learners provides sufficient scope for them to complete the assessment fully.

For Distinction standard, learners will produce a well-developed, accurate and entirely realistic horticultural activity plan. Learners will show a comprehensive knowledge and understanding of the key aspects of the horticultural plan for an event, fully considering the aspects listed in the unit content along with any other appropriate planning requirements that are logical and well justified. The plan will include different horticultural tasks, resources and roles which contribute logically to a coherent horticultural event activity. They will demonstrate a consistently accurate application of knowledge and skills from the assessment completed in *Unit 35: Participating in Horticultural Tasks at Events* by showing a comprehensive, in-depth understanding of the types of horticultural role and task that need to be reviewed in order to produce an effective plan for a horticultural activity in an event setting. In producing the horticultural plan, learners will also accurately select and apply in-depth knowledge of resources and procedures gained from *Unit 35: Participating in Horticultural Tasks at Events*. They will give well-reasoned justifications for their recommended plan and show an in-depth understanding of the indicators used to measure the effectiveness of their plan in meeting a given brief.

Learners will provide clearly outlined and realistic, effective financial costings for their horticultural plan, including using all aspects of the unit content appropriately. The plan must be produced so it could be implemented. Although learners are not expected to implement the plan, they will give a robust review of the effectiveness of the horticultural plan in meeting a given brief. Their event plans will be effectively presented. Information will be organised in a logical way, presented in a professional format and be suitable for potential use by an event manager. Learners will show both breadth and depth in their knowledge and understanding with robust justifications. Learners will use appropriate terminology consistently and accurately throughout.

For Merit standard, learners will produce a mainly accurate and realistic horticultural activity plan. They will show a detailed knowledge and understanding of the key aspects of the horticultural plan for an event, covering the aspects listed in the unit content along with any other appropriate planning aspects, providing some valid justification for their views. The plan will include different horticultural tasks, resources and roles that are linked in a mostly valid way for the horticultural event activity. Learners will demonstrate a clear and mostly relevant application of their knowledge and skills from the assessment completed in *Unit 35: Participating in Horticultural Tasks at Events* by showing a detailed understanding of the types of horticultural role and task that need to be reviewed in order to produce an effective plan for a horticultural activity in an event setting. In producing the horticultural plan, learners will select and apply a detailed knowledge of resources and procedures gained from *Unit 35: Participating in Horticultural Tasks at Events*. Individual parts of the plan will be clear, with partially developed reasons for actions and approaches suggested in the plan. Learners will show a mostly relevant understanding of the indicators used to measure the effectiveness of their plan in meeting a given brief.

Learners will give realistic, efficient financial costings for their chosen horticultural plan, including using all aspects of the unit content appropriately. They will give mostly valid justifications for actions and decisions taken. The plan must be produced so it could be implemented. Although learners are not expected to implement the plan, they will give a detailed review of the effectiveness of the horticultural plan in meeting a given brief. Their event plans will be well presented and generally suitable for use by an event manager. Learners will use appropriate terminology accurately.

For Pass standard, learners will produce a basic but realistic event plan for a horticultural activity. They will show some relevant knowledge and understanding of the key components of a horticultural plan for an event, covering the aspects listed in the unit content along with any other appropriate planning aspects. They will provide undeveloped explanations for choices made in their plan. The plan will include a limited range of horticultural tasks, resources and roles that are realistic for the chosen horticultural event activity. Learners will show a limited application of their knowledge and skills from the assessment completed in *Unit 35: Participating in Horticultural Tasks at Events* by showing a realistic but undeveloped understanding of the types of horticultural role and task that need to be reviewed in order to produce an effective plan for a horticultural activity in an event setting. In producing the horticultural plan, learners will select and apply a limited but realistic knowledge of resources and procedures gained from *Unit 35: Participating in Horticultural Tasks at Events*. Individual aspects of the plan will be appropriate but limited in scope, presenting undeveloped or generic reasons for suggested actions and approaches in the plan. They will show some relevant but limited understanding of the indicators used to measure the effectiveness of their plan in meeting a given brief.

Learners will provide realistic outlines of efficient financial costings for their horticultural plan, including all aspects of the unit content. They will give basic explanations for actions and decisions taken, showing limited breadth and depth in their knowledge and understanding. The plan must be produced so it could be implemented. Learners are not expected to implement the plan but they will give a basic review of the effectiveness of the horticultural plan in meeting a given brief. Their event plans will be appropriately presented with relevant headings and titles, but will not fully meet the requirements for use by an event manager. Learners will use basic terminology with some accuracy.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 7: Work Experience in the Land-based Sectors
- Unit 27: Identification, Planting and Care of Plants
- Unit 28: Routine Plant Management
- Unit 29: Plant Propagation Activities
- Unit 33: Pests and Disease in Plants
- Unit 35: Participating in Horticultural Tasks at Events.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops and masterclasses with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- reflective practices when considering horticultural activities
- practical application when reflecting on different event requirements.

Unit 37: Maintaining the Health and Quality of Turf in Parks and Gardens

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills and knowledge needed to be able to plan and carry out the maintenance requirements of park and garden turf in order to support its health.

Unit introduction

Planning the maintenance of park and garden turf, and improving its health, covers a range of tasks – from regular mowing to aeration, irrigation and feeding. To ensure that the turf is high quality, it is vital to know when and how to carry out these tasks.

In this unit, you will investigate the maintenance requirements of turf in parks and gardens. You will research a range of maintenance tasks, consider how often they need to be carried out, and the seasonal impacts that affect turf maintenance. You will use this knowledge to produce a maintenance plan for a specific area of turf, complete the required practical maintenance tasks and then review the effectiveness of your own performance.

This unit will give you skills that will allow you to identify, plan and carry out maintenance tasks for an area of park or garden turf. These skills will help you to progress to employment in a role such as gardener, park ranger, landscaper, plant salesperson, adviser. Alternatively, you may wish to continue your study to higher education, for example to a degree in horticulture.

Learning aims

In this unit you will:

A Investigate the maintenance requirements of turf in parks and gardens

B Plan a schedule for an area of turf to support its health and maintenance

C Carry out maintenance for an area of turf to enhance its health and quality.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the maintenance requirements of turf in parks and gardens	**A1** Maintenance operations of turf in parks and gardens **A2** Factors that affect maintenance operations **A3** Repair and renovation requirements of turf in parks and gardens	A report on the maintenance requirements to enhance turf health.
B Plan a schedule for an area of turf to support its health and maintenance	**B1** Planning turf maintenance for an area of a park or garden **B2** Seasonal impacts on maintenance planning for turf in parks and gardens **B3** Key features of a turf-maintenance plan	Portfolio of evidence, to include: • inspection of an area of turf, reporting on its health • maintenance plan for an area of turf • evidence of maintenance tasks carried out • report on the effect of maintenance on the quality of turf.
C Carry out maintenance for an area of turf to enhance its health and quality	**C1** Preparing to undertake turf maintenance in parks and gardens **C2** Completing maintenance tasks **C3** Reviewing outcomes of maintenance tasks	

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Content

Learning aim A: Investigate the maintenance requirements of turf in parks and gardens

A1 Maintenance operations of turf in parks and gardens

- Areas of turf, e.g. public and recreational parks, green areas, conservation areas, residential gardens, estate gardens.
- Maintenance operations and their key aspects, including type, frequency, maintaining health and meeting specific requirements of turf area:
  - mowing, including cutting heights
  - scarifying
  - aeration
  - rolling
  - switching/brushing
  - edging.
- Feeding of turf, including summer and winter programmes.
- Applications, including top dressing, granular, liquid.
- Irrigation methods, including summer and winter programmes, oscillating sprinklers, hand watering, boom sprayers, self-propelled or travelling watering systems.
- Waste removal and correct disposal, in line with sustainable practices:
  - organic and inorganic waste, including general rubbish, animal waste, food waste, boxed-off clippings, plant debris.
- Range of tools and equipment to plan and manage maintenance.
- Knowing the appropriate tools and equipment to use in each maintenance situation.
- Pedestrian machinery:
  - mowers, e.g. rotary, cylinder, hover
  - scarifier
  - aerator
  - knapsack sprayer
  - fertiliser spreader
  - backpack leaf blower.
- Ride-on machinery:
  - mowers
  - tractors and mounted attachments
  - sprayers.
- Hand tools:
  - rakes
  - half moon
  - besom or broom
  - spade
  - shovel
  - fork.
- Powered hand tools:
  - strimmers and brush cutters
  - hand-held leaf blower.
- Essential maintenance requirements of tools, equipment and machinery.

A2 Factors that affect maintenance operations

Health of turf and turf inspection, positive identification of threats to turf health and impact of these threats.

- Pests, such as:
  - chafer grubs, ants, leatherjackets, moles, rabbits, birds, earthworms.
- Diseases, such as:
  - *Fusarium*, toadstools, red thread, rust, fairy rings.
- Disorders, such as:
  - dry patch, nutrient deficiencies, thatch, compaction, waterlogging.
- Other threats, such as:
  - dog urine, machinery damage, man-made damage.
- Moss and weed identification and control, including daisy, buttercup, dandelion, yarrow, clover, plantain, speedwell, birdsfoot trefoil, weed grasses, including annual meadow grass, ryegrass.
- Responding to threats to turf, through:
  - physical methods, e.g. by hand and machine
  - chemical methods, e.g. fungicides, pesticides, herbicides, selective treatments
  - biological methods, e.g. the use of bacteria, fungi or nematodes
  - cultural methods, e.g. regular maintenance operations.
- Leaving turf areas unmaintained, including:
  - purpose, e.g. spring bulb growth, wildflower areas, around trees
  - importance of unmaintained turf for newly laid turf areas, newly seeded areas, wildlife habitats
  - potential issues, including aesthetics, complaints from the public, pests, diseases and weed problems.

A3 Repair and renovation requirements of turf in parks and gardens

- Importance of selecting the correct repair or renovation method.
- Types of repair and renovation, such as:
  - patching
  - plugging
  - over-seeding
  - forking-up
  - re-edging
  - re-turfing
  - re-seeding.
- Identification of grass types and mixes for different areas to be repaired or renovated:
  - perennial ryegrass (*Lolium perenne*), creeping red fescue (*Festuca rubra*), smooth-stalked meadow grass (*Poa pratenis*), bentgrass (Agrostis) or similar grasses
  - grass mixes for hard-wearing, fine lawns and shade tolerance.
- Assessment of area requiring repair or renovation, including extent of damage, most suitable method, size of area, time of year, area usage, resource requirements, costs involved, time required to complete task and time it will take for area to re-establish.
- Factors affecting repair and renovation, including soil type and condition, grass type, timings, methods used, weather.

Learning aim B: Plan a schedule for an area of turf to support its health and maintenance

Area of maintenance being planned, and type and frequency of maintenance operations.

B1 Planning turf maintenance for an area of a park or garden

- Characteristics of turf areas, including soil, aspect, topography, air movement.
- Aims of maintenance, e.g. improve grass cover, improve health of turf, reduce weeds, improve drainage, reduce compaction.
- Setting objectives to achieve maintenance aims, e.g. removing debris from area, disposing of all waste correctly and in line with sustainable practices, over-seeding area of maintenance operations; resource planning.
- Meeting quality standards
  - Turfgrass Growers Association (TGA).
- Meeting current legislative requirements, including:
  - health and safety at work legislation
  - safe use of chemicals
  - safe use of work equipment
  - reporting of injuries
  - manual handling operations legislation
  - environmental legislation
  - waste disposal regulations.

B2 Seasonal impacts on maintenance planning for turf in parks and gardens

- Impact that seasons have on maintenance planning, including operations, climate, aspect and soil.
- Impact of weather and climate, forecast, average weather conditions, precipitation, shade, frost, maximum and minimum temperatures, air movement, extreme weather events.

B3 Key features of a turf-maintenance plan

- Key areas that should be included in a maintenance plan:
  - location, characteristics and limitation of the land
  - aims and objectives, e.g. what needs to be achieved and the steps taken towards achieving it
  - resource requirements, e.g. tools, equipment, machinery, personnel
  - legal requirements, e.g. risk assessments, staff training requirements such as pesticide applications (PA1, PA2, PA6)/international equivalents
  - costs and resources, e.g. staff, materials
  - maintenance operation timings
  - contingency planning for poor weather, staff absence, unfavourable ground conditions, unavailability of machinery, dealing with any other relevant problems and issues
  - key event planning.
- Document format to suit area being planned, e.g. wallplanners, diaries, spreadsheets, including dates, week numbers.

Learning aim C: Carry out maintenance for an area of turf to enhance its health and quality

C1 Preparing to undertake turf maintenance in parks and gardens

- Assessment of risk and working safely:
  - identification of hazards and risks of the work area (related to tools, equipment and people) and how they can be minimised, including essential personal protective equipment (PPE)
  - methods for working safely and minimising damage to working areas.
- Correct tools, materials and equipment to maintain turf areas:
  - selection of tools, equipment and machinery relevant to area of maintenance
  - safe transportation of tools, equipment and machinery to area of maintenance.
- Assessment of area before tasks:
  - suitable condition for maintenance task, including assessment of ground and weather conditions
  - removal of debris, organic and inorganic waste before carrying out maintenance tasks and ensuring correct disposal.

C2 Completing maintenance tasks

Safe completion of maintenance tasks to suit area of turf, time of year and working from the plan.

- Safe working practices, e.g. safe use of equipment, appropriate training, appropriate procedures for lone working, considering public right of way, compliance with relevant legislation, codes of practice and work specifications, e.g. wearing correct PPE, following risk assessments and minimising risk.
- Correct use, maintenance and storage of tools, materials, machinery and equipment.
- Safe completion of maintenance tasks.
- Minimising environmental damage and maintaining site conditions while carrying out maintenance tasks, e.g. debris removal control, minimising public access, monitoring turf conditions.
- Area of work left tidy and presentable using markers, signs or ground under repair (GUR) or no play zone (NPZ) signs where appropriate; safe disposal of organic and inorganic waste in line with sustainable practices.

C3 Reviewing outcomes of maintenance tasks

- Checking that standards meet basic recreational use.
- Checking that the requirements of the turf area are met, e.g. adequate grass cover, low level of weed coverage, turf is in good health, areas are left unmaintained where required.
- Effectiveness of maintenance tasks, e.g. area improvements seen, growth improvements.
- Measuring actual outcomes against planned outcomes, e.g. inspection and monitoring of areas.
- Impact of maintenance tasks, their role in enhancing the quality of the turf and how the review process can inform future maintenance strategies, e.g. lessons learned, identified improvements, recommendations for improvement, recording results on the maintenance plan.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Investigate the maintenance requirements of turf in parks and gardens</td><td rowspan="2">A.D1 Analyse different maintenance requirements of turf in parks and gardens, including how maintenance enhances turf health.</td></tr>
<tr><td>A.P1 Explain different maintenance requirements of turf areas in parks and gardens, including situations where grassed areas may be left unmaintained.
A.P2 Explain common turf threats, pests, diseases, disorders, moss and weeds and their control.</td><td>A.M1 Assess different maintenance requirements of turf in parks and gardens, and the role of maintenance methods in improving turf health.</td></tr>
<tr><td colspan="2">Learning aim B: Plan a schedule for an area of turf to support its health and maintenance</td><td rowspan="2">B.D2 Produce a comprehensive maintenance schedule to improve the health of the area of park or garden turf that has been inspected.</td></tr>
<tr><td>B.P3 Carry out a full inspection on an area of park or garden turf.
B.P4 Produce a basic maintenance schedule for park or garden turf in order to improve turf health.</td><td>B.M2 Produce a detailed maintenance schedule to improve the health of park or garden turf that has been inspected.</td></tr>
<tr><td colspan="2">Learning aim C: Carry out maintenance for an area of turf to enhance its health and quality</td><td rowspan="2">C.D3 Demonstrate, with a high degree of accuracy and efficiency, the maintenance of an area of park or garden turf, evaluating the impact of own maintenance schedule on turf health.</td></tr>
<tr><td>C.P5 Demonstrate competent maintenance of an area of park or garden turf, using appropriate and safe methods.
C.P6 Explain contribution of own maintenance schedule in maintaining the health of park or garden turf.</td><td>C.M3 Demonstrate efficient maintenance of an area of park or garden turf, analysing impact of own maintenance schedule on turf health.</td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of park and garden areas to visit (this could be off site)
- an area of park or garden turf to plan for and carry out maintenance on
- appropriate, well-maintained tools, machinery, equipment and materials for carrying out turf-maintenance tasks
- suitable PPE.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will provide a thorough, accurate account of the maintenance requirements of park and garden turf areas. They will demonstrate both depth and breadth of understanding of the different requirements of turf areas, and the relationship between specific turf needs and turf maintenance.

Learners will give a comprehensive account of how effective maintenance enhances the health of turf, giving consistently relevant examples of maintenance activities and how they improve health. Learners will have a depth of knowledge that shows links between the health of turf and a robust maintenance plan.

Learners will give comprehensive, insightful information on the factors that adversely affect maintenance operations and will recommend ways of overcoming these factors effectively. Learners will investigate thoroughly common turf threats, pests, diseases, disorders, weeds and moss from a wide range of sources, and discuss their control, giving detailed, relevant examples. Learners will, throughout their work, use consistently accurate technical terminology and botanical naming related to threats, pests, diseases, disorders, weeds and moss control.

For Merit standard, learners will examine fully the maintenance requirements of park and garden turf areas. They will demonstrate a clear understanding and breadth of knowledge of the different requirements of turf areas, and the relationship between turf needs and turf maintenance.

Learners will present a detailed account of how effective maintenance enhances the quality of turf, giving mostly relevant examples of how regular maintenance activities can ensure that quality is maintained and mostly valid examples of when turf may be left unmaintained, giving clear reasoning for this.

Learners will give clear examples of the factors that adversely affect maintenance operations and will show understanding of the need to take these factors into consideration when planning a maintenance schedule. Learners will investigate common turf threats, pests, diseases, disorders, weeds and moss from a range of sources and describe their control, giving mostly relevant examples. Learners will use appropriate technical terminology and botanical naming related to threat, pest, disease, disorder, weeds and moss control.

For Pass standard, learners will report on the basic maintenance requirements for turf in parks and gardens, making generally realistic links between the different turf areas and their maintenance requirements. Learners will give a basic explanation of how effective maintenance enhances the health of turf but some aspects of their explanation may be generic or limited in scope. They will include some relevant examples of when turf may be left unmaintained, giving realistic but undeveloped reasons for this.

Learners will also investigate common turf threats, pests, diseases, disorders, weeds and moss from given sources and state their control, giving some relevant examples. Learners will use some appropriate technical terminology and botanical naming related to threats, pests, diseases, disorders, weeds and moss control but there may be some inconsistencies and common names may be used.

Learning aims B and C

To achieve learning aims B and C, learners must individually plan and carry out maintenance tasks for an area of park or garden turf to support its health. Teachers should ensure that the area of park or garden turf chosen by learners provides sufficient scope for them to complete the assessment fully.

For Distinction standard, learners will, through a thorough inspection of the area, demonstrate logical and comprehensive reasoning for the approach taken to maintaining the health of an area of park or garden turf. Learners will consider all relevant aspects that may affect successful maintenance and the health of the turf. This will include giving full, accurate details of the requirements for successful maintenance and making insightful, coherent links to the site conditions.

Learners will produce a comprehensive maintenance plan for an area of turf, including entirely valid aims and objectives that meet accurately the needs of the turf area, robust weekly tasks, location, timings, key events and resource planning. The plan will show logical, effective organisation of tasks and will fully justify their decisions in relation to the suitability of the tasks to be carried out.

Learners will show effective ways to minimise risks and fully demonstrate competent safe working practices throughout. They will consistently select the correct tools, materials and equipment, using them effectively and safely. Learners will carry out maintenance that is highly effective in supporting the quality of turf. They will show insight in reflecting on the decisions they made during the practical tasks carried out.

Learners will show breadth and depth of understanding of the turf requirements that support the quality of turf before and during maintenance. Highly effective care of the turf will be given throughout.

Learners will review thoroughly the methods they used for maintaining the health of turf and explore where they were successful, and where methods could be improved or carried out differently.

For Merit standard, learners will demonstrate that they have assessed the park or garden turf area to establish clear, relevant maintenance requirements. The maintenance requirements will be clearly linked to improving turf health and mostly match the site conditions. They will give clear reasons for their approach, supported by mostly relevant examples.

Learners will produce a detailed maintenance plan for an area of turf that identifies aims and objectives that mostly meet the needs of the given area, including weekly tasks, location, timings, key events and resource planning.

Learners will carry out maintenance efficiently, showing that they have optimised the given area through the preparation of the turf, and by demonstrating efficiency in the time taken, resources used and minimal disruption during the maintenance tasks. They will consider ground conditions and prepare the area appropriately. They will assess the hazards and risks involved in carrying out the practical tasks, and use the required tools, materials and equipment safely and competently.

Learners will show breadth and some depth of knowledge of maintenance requirements to enhance the health of the given area. They will reflect on the methods they used and make generally clear connections to their impact on successfully maintaining the health of the turf area.

For Pass standard, learners will inspect the features and characteristics of an area of park or garden turf, demonstrating a realistic but undeveloped understanding of the area and maintenance requirements to improve health and any limiting factors.

Learners will produce a simple maintenance plan, outlining the features and characteristics of an area, taking account of these aspects of the plan. They will give some relevant reasons to show how the maintenance tasks ensure that the turf remains healthy.

Learners will work safely, with an awareness of the risks and potential issues arising when carrying out maintenance tasks. They will use appropriate methods, tools and equipment to prepare the area and carry out maintenance tasks, leaving the area clean and tidy on completion.

On completion of tasks, learners will remove and store tools, materials and equipment safely, disposing of waste materials appropriately.

Learners will provide realistic but undeveloped reasons for their selected methods of maintenance, demonstrating appropriate but limited understanding of the impact these methods have on maintaining the health of turf.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 23: Land-based Machinery Operations
- Unit 32: Maintenance of Sports and Amenity Turf
- Unit 42: Landscape and Garden Design.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops
- masterclasses with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- practical application when reflecting on different turf requirements
- safe working practices and procedures when maintaining turf.

Unit 38: Protected Horticultural Crop Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners will explore and develop the skills to cultivate, grow and maintain a selection of protected crops in preparation for market outlets.

Unit introduction

Crop production is an important sector in the horticultural industry as it is a key employer of specialist horticulture staff. Traditional crops are still produced but the ongoing introduction of crops for foliage, stem and berry plant production, and the increased use of direct-sown cut flowers represents an important and broad section of total horticultural crop production.

This unit will help you to develop an understanding of a range of commercial protected horticultural crops. You will concentrate on protected vegetables, cut flowers, interior plants and successional bedding. You will develop the skills needed to identify a range of sites, structures and facilities for the propagation and growing on of a range of protected horticultural crops. You will use various establishment and maintenance techniques to meet specified requirements to provide aftercare for plants so that they are established successfully. You will also prepare crops for market.

This unit will help you to progress to employment in plant husbandry in roles in the land-based sectors such as nursery worker, plant propagator, plant grower, head gardener, retailer, quality assurer, horticultural scientist and crop physiologist. You could also progress to the role of advanced apprentice or to a higher-education course such as a degree in horticulture.

Learning aims

In this unit you will:

A Investigate key requirements for the commercial production of protected horticultural crops

B Carry out the establishment and maintenance of protected horticultural crops

C Use accepted working practices to carry out harvesting, grading and storage of protected horticultural crops.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate key requirements for the commercial production of protected horticultural crops	**A1** Plant suitability for protected horticultural crop production systems **A2** Site selection and growing systems for protected horticultural crops **A3** Resource requirements **A4** Factors affecting the management of plant growth and establishment	An illustrated report or presentation researching site considerations, facilities and techniques (including the use of organics) in the management of commercial protected crop production for two contrasting protected horticultural crops, one of which meets approved organic guidelines.
B Carry out the establishment and maintenance of protected horticultural crops	**B1** Site preparation and establishment methods for protected horticultural crops **B2** Maintaining protected horticultural crops	Evidence of carrying out tasks in establishing, maintaining, harvesting, grading and storage of protected horticultural crops to meet current standards and production targets. Completion of appropriate records.
C Use accepted working practices to carry out harvesting, grading and storage of protected horticultural crops	**C1** Harvesting and grading of protected horticultural crops **C2** Maintaining the shelf life of protected horticultural crops	

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Content

Learning aim A: Investigate key requirements for the commercial production of protected horticultural crops

A1 Plant suitability for protected horticultural crop production systems

Categorising protected crops as listed below or other similar crop varieties, considering age, size and intended market.

- Plant types:
  - protected vegetables, e.g. tomatoes, peppers, chillies and miscellaneous vegetables, e.g. mushrooms
  - successional bedding plants such as those for spring, e.g. *Viola* x *wittrockiana* and those for summer, e.g. *Lobelia erinus*
  - cut flowers, e.g. *Dianthus caryophyllus* or *Lathyrus odoratus* cvs.
  - foliage and stems, e.g. *Ilex* spp., *Salix* spp.
  - houseplants, e.g. *Saintpaulia ionantha*, *Azalea* cvs.
- Types of plant production for protected crops, e.g. seeds, cuttings.

A2 Site selection and growing systems for protected horticultural crops

- Site considerations for protected crops:
  - soil and soil-less growing media, including structure, texture, pH, depth, fertility and water-holding qualities
  - seasonal characteristics, including drought, frost, waterlogging, rotations, cropping sequences
  - aspect, topography, exposure, protection
  - access requirements to site for growing and harvesting operations
  - availability of services, e.g. mains water, drainage and electricity
  - structures, including production, potting and packing areas
  - irrigation requirements
  - relevant legislation, e.g. planning regulations or Environment Act 1995
  - location of end users, including proximity to markets.
- Organic status requirements:
  - certification of organic status overseen by various bodies, e.g. organic authorities for the environment, food, rural issues, soil
  - benefits and limitations of certified status for growers, e.g. philosophy, marketing niche, product premium
  - time and cost required to convert and availability of inputs, e.g. propagation material and/or manures, growing in soil only.
- Management techniques available to the organic grower:
  - the role of soil health and fertility through various practices, e.g. maintaining humus levels, use of green manures, crop rotation, soil coverage and minimum cultivation
  - nutrient management protocols, e.g. 'acceptable/permitted', 'prior approval required' and 'never acceptable/prohibited'
  - organic weed, pest and disease management, e.g. hygiene, mulching, varietal selection.

A3 Resource requirements

Establishing the requirements for production, considering the type and size for protected crops.

- Work area requirements:
  - buildings and structures for tasks, e.g. potting on and propagation, storage of plants or equipment and materials
  - tools and equipment for protected crops, e.g. secateurs, use of soil sterilisers
  - equipment, e.g. temperature control or supplementary and replacement lighting
  - materials, including containers and labels
  - information for recording purposes, e.g. computerised and manual management systems, cropping schedules.

A4 Factors affecting the management of plant growth and establishment

- Managing and monitoring plant growth:
  - growing space available, seed densities, spacing correctly for time of year, stage of development, shape and size of plant, thinning, pruning, trimming, providing support.
- Managing the health of crops:
  - monitoring and control of pests, e.g. insects, rodents
  - diseases, including fungal and bacterial
  - viruses and disorders, including nutrient deficiencies, climatic effects, mechanical damage, pollutants, hygiene
  - application of feed, including requirements for major, secondary and minor nutrients, top dressing, base dressing, granules, powders, liquid, slow release, fertigation.
- Factors affecting timeline planning, including:
  - natural growth times of crop
  - work schedules for planting, maintenance and harvest
  - contingency planning for production problems, e.g. adverse weather or staff absence
  - production timings of plants, seasonal marketing considerations, production costing versus pricing.
- Key principles of laws/legislation and regulations governing safe working and personal protective equipment.

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Learning aim B: Carry out the establishment and maintenance of protected horticultural crops

B1 Site preparation and establishment methods for protected horticultural crops

- Preparation of growing area:
  - current soil cultivations for protected crops, e.g. sub-soiling and drainage, bed formation, management of soil pH
  - protected cropping areas, e.g. glasshouses, polytunnels, cold frames
  - preparation methods, e.g. planning for sequential cropping and rotation
  - propagation methods, e.g. seeding or cuttings
  - types and sizes of containers
  - media, including peat-based, peat-free and combination mixes
  - seed, cuttings, pre-grown seedling and plugs, rooted cuttings, growing on, irrigation, nutrition
  - environmental control, health and safety considerations, pest, disease and weed control
  - setting out of areas as required
  - laws/legislation covering health and safety at work and risk assessment
  - completing relevant records, e.g. propagation log, crop record.
- Selection and use of correct tools, machinery, equipment and materials for specified production tasks.
- Sowing and planting:
  - production tasks for crops during different stages of development as appropriate, e.g. preparing ground by manual and/or by mechanical means, use of robotics, planting
  - provide growing conditions to suit specified crop establishment, e.g. include light, water or spacing to suit stage of development
  - working safely, minimising damage to working area, disposing of waste correctly.

B2 Maintaining protected horticultural crops

- Maintenance and monitoring:
  - pruning, tidying, supporting and training
  - providing protection as appropriate to plant, time of year and weather conditions
  - irrigation, application of fertiliser, pinching-out
  - use of environmental-control equipment, e.g. thermal, blackout and aspirated screens, lighting and potting, in order to manipulate the crop
  - remove weeds, feed and water plants as appropriate.
- Crop health checks:
  - pests, diseases and disorders, good hygiene practices.
- Selection and use of harvest methods appropriate to plant type.
- Working safely, minimising damage to working area, disposing of waste correctly.
- Completion of appropriate records, e.g. propagation record, growing-on log, crop records, to enable review.

Learning aim C: Use accepted working practices to carry out harvesting, grading and storage of protected horticultural crops

Harvesting and grading of crops to meet EU or other required standards.

C1 Harvesting and grading of protected horticultural crops

- Maturation characteristics, e.g. tissue protective coating, size, stage of development.
- Presentation:
  - packaging and labelling that conforms to EU or other required standards
  - harvesting containers.
- Selection and use of harvesting methods.
- Waste materials and management.
- Environmental impact, e.g. water and eutrophication, energy use.
- Health and safety issues relevant to horticultural crop harvesting and grading, including:
  - safe working practices
  - potential consequences of not complying with safe working practices, e.g. injury to self or others.

C2 Maintaining the shelf life of protected horticultural crops

- Post-harvest handling, e.g. cleaning.
- Cooling methods, e.g. pre-cooling, air pre-cooling, vacuum cooling.
- Storage, e.g. in situ, evaporative cooling.
- Pest control and decay.
- Organisations associated with standards, e.g. linked to rural subsidies, quality of crops.
- Specialist international quality standards such as those linked to:
  - plant passports and accreditation schemes
  - marketing rules ensuring accurate labelling, products of acceptable quality and that unsatisfactory products do not reach market.
- Relevant current laws/legislation, e.g. those governing marketing of fresh crops and labelling of crops.

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Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate key requirements for the commercial production of protected horticultural crops		
A.P1 Explain the requirements for the production of two contrasting commercial protected horticultural crops, one of which meets approved organic guidelines. **A.P2** Explain the factors affecting the management of plant growth and establishment for the production of two contrasting commercial protected horticultural crops, one of which meets approved organic guidelines.	**A.M1** Compare the requirements of two contrasting commercial protected horticultural crops, one of which meets approved organic guidelines, analysing the factors affecting their growth and establishment.	**A.D1** Assess the requirements for two contrasting commercial protected horticultural crops, one of which meets approved organic guidelines, evaluating the factors that affect their successful growth and development.
Learning aim B: Carry out the establishment and maintenance of protected horticultural crops		
B.P3 Competently carry out tasks to establish protected horticultural crops. **B.P4** Competently carry out tasks to maintain protected horticultural crops.	**B.M2** Efficiently carry out tasks to establish and maintain protected horticultural crops.	**B.D2** Carry out, with a high degree of accuracy, tasks to establish and maintain protected horticultural crops.
Learning aim C: Use accepted working practices to carry out harvesting, grading and storage of protected horticultural crops		
C.P5 Competently carry out a crop harvesting and grading task for protected horticultural crops to meet objectives. **C.P6** Competently carry out a protected crop monitoring task to meet objectives in given storage facilities.	**C.M3** Efficiently carry out protected crop harvesting, grading and monitoring tasks to meet objectives, relating the results of monitoring to crop harvesting, grading, and cleaning requirements in the given storage facilities.	**C.D3** Carry out the harvesting, grading and monitoring of protected horticultural crops with a high degree of accuracy, evaluating the impact of growing, harvesting and storage of the crops on the quality of the final product.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- appropriate, well-maintained tools and equipment and materials for carrying out production techniques
- suitable personal protective equipment (PPE)
- a suitable range of environmental-control equipment and systems
- a range of physical structures such as a greenhouse or polythene tunnel to carry out production and growing tasks
- a range of plant material for propagation, production and maintenance
- for research, a library with a range of books, periodicals, brochures, catalogues and access to the internet.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give a comprehensive, insightful account of the production requirements of one edible and one ornamental plant, using examples of plants that have complex needs, one of which needs to meet approved organic guidelines. Learners will make consistently valid links between how production requirements and their timings can affect the successful establishment of protected horticultural crops.

Learners will carry out a thorough review of the factors that affect the management of plant growth across both edible and ornamental protected horticultural crops, providing valid conclusions as to which are the most appropriate. The evidence will show clearly both breadth and depth of knowledge of relevant production requirements. Learners will use technical terms confidently and consistently, using the full and accurate botanical names of plants.

Learners' work will show evidence of meticulous planning and a logical, effective structure of ideas and supporting examples.

For Merit standard, learners will give a detailed account of the production requirements of one edible and one ornamental plant, which have a range of different needs; one of which needs to meet approved organic guidelines. They will make mostly relevant comparisons between edible and ornamental protected horticultural crops and assess how timings can affect their successful establishment. The evidence will show breadth and some depth of knowledge of relevant production requirements.

Learners will present their work in a generally well-structured and logical way, making appropriate reference to the botanical plant names.

For Pass standard, learners will identify some of the key requirements of producing both edible and ornamental protected horticultural crops, using examples of plants that have quite similar needs, one of which needs to meet approved organic guidelines. Learners will show some breadth of understanding of the production requirements, demonstrating an appropriate but limited understanding of their timing. Learners will show a realistic but undeveloped understanding of the main factors that affect the establishment of protected horticultural crops. Their explanations may be unbalanced or generic in parts. Learners will present information with some accuracy, showing that they have an understanding of some of the botanical names, although some minor omissions or inaccuracies may occur.

Learning aims B and C

Learners will individually carry out tasks in establishing, maintaining, harvesting, grading and storage of protected horticultural crops, including the completion of appropriate records.

For Distinction standard, learners will actively promote safety throughout the production process, taking reasonable steps within the limits of their own responsibility to ensure the safety of themselves and others, anticipating dangers and acting accordingly. They will prepare and operate tools and equipment safely to a standard that reflects best practice in the workplace. All tasks will be conducted thoroughly, with meticulous attention to detail and according to the instructions given in the task brief.

Learners will demonstrate consistently both depth and breadth of understanding of the potential links between a range of tasks and their effectiveness in maintaining plants, and growing on post-propagation through to harvest. Learners will show an in-depth awareness of the impact these tasks have on the structures, facilities and integrated pest management and intended use, such as for the successional supply of food and/or flowers for the cut-flower industry. Additional secondary research will be evidenced, including research from industry visits such as those to bedding suppliers, salad and houseplant growers.

Learners will harvest (including loading), grade and store protected crops safely and efficiently. They will carry out monitoring tasks with a very high degree of accuracy and make detailed, insightful suggestions of how crops should be stored. It is likely, but not essential, that learners will relate their suggestions to the harvesting, grading and storing tasks they carried out. Learners will consistently and accurately relate the effects of growing, harvesting and storage conditions to the quality of the crop and food safety. They will demonstrate a robust understanding of the importance of store hygiene in reducing infestations, and evaluate how infestations can affect crop quality and, in turn, affect food hygiene. Learners will provide specific, valid reasons that link logically to their views. They will make effective judgements on the relative importance of different aspects of crop harvesting, grading and storage, drawing on the results of their monitoring and harvesting activities. The evidence will show consistent use of relevant and accurate terminology.

For Merit standard, learners will prepare and operate tools and equipment safely. Husbandry techniques will be carried out in a time-efficient and generally appropriate manner, with clear reference to the task brief. Learners will demonstrate breadth and some depth of understanding and knowledge of the key factors that have an impact on the successful establishment and maintenance of named crops.

Learners will work safely and show an awareness of the potential dangers to themselves and others, within the limits of their own responsibility. They will prepare and use required tools and equipment safely and competently. Plant maintenance tasks will be carried out in a time-efficient manner, with clear and mostly relevant reference to the brief.

Learners will harvest (including loading), grade and store protected crops appropriately and safely. They will monitor stored crop products accurately. Learners will relate harvesting conditions and the results of correct grading monitoring to crop storage conditions clearly, and will make mostly relevant suggestions as to how these issues relate to crop quality. They will show a clear understanding of the importance of store hygiene and give mainly accurate justifications for it, including reducing pest, disease or vermin infestation, but not necessarily relating the effects of infestations to long-term food safety. The evidence will make accurate use of appropriate horticultural terminology.

For Pass standard, learners must safely carry out establishment, maintenance and harvesting techniques for at least two protected crops. This will include risk assessing tasks.

Learners will demonstrate some breadth of knowledge and understanding of the key factors that have an impact on the successful establishment and maintenance of named crops.

Learners will use appropriate personal protective equipment, such as gloves and footwear. They will use required tools and equipment safely and appropriately within the limits of their own responsibility, taking reasonable steps to ensure that other personnel are not in danger from their activities, such as colleagues working closely in pruning activities, or when machinery and equipment is being used.

Edibles and ornamentals will be covered from the point of preparation of the soil, establishing plants, ongoing maintenance up to harvesting, through to the use of appropriate structures and facilities. When referring to edibles, learners could provide evidence to support the production of fruit and the successional supply of vegetables. For ornamentals, they could produce plants that would supply the cut-flower market. Learners will complete tasks competently, in line with the brief given to them.

Learners will harvest (including loading), grade and store given crops safely. They will carry out monitoring tasks with an appropriate degree of accuracy but this will be limited in scope and might not relate harvesting and conditioning to crop quality. Learners will suggest appropriate on-site use, unloading, transportation, segregation, conditioning, grading, sorting, or cleaning requirements, as appropriate. They will demonstrate a realistic understanding of the importance of store hygiene but will not indicate the reasons in any depth or detail. There may be some minor irrelevancies in the evidence, and some agricultural terminology may be omitted.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 7: Work Experience in the Land-based Sectors
- Unit 27: Identification, Planting and Care of Plants
- Unit 28: Routine Plant Management
- Unit 29: Plant Propagation Activities
- Unit 31: Nursery Stock Production
- Unit 33: Pests and Disease in Plants
- Unit 39: Outdoor Horticultural Crop Production.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops
- masterclasses with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills when investigating organic guidelines
- personal skills when working with others
- self-management skills when carrying out protected crop techniques.

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Unit 39: Outdoor Horticultural Crop Production

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners will explore and develop the skills to cultivate, grow and maintain a selection of outdoor crops in preparation for market outlets.

Unit introduction

Crop production is an important sector in the horticultural industry; the sector is a key employer of specialist horticulture staff. Traditional crops are still produced but the ongoing introduction of new and emerging crops represents an important and broad section of total horticultural crop production.

This unit will help you to develop an understanding of a range of commercial outdoor horticultural crops (excluding hardy nursery stock), concentrating on edibles, such as fruit and vegetables, bulbs and cut flowers and foliage. You will develop the skills needed to identify a range of sites, structures and facilities for the propagation and growing on of a range of outdoor horticultural crops. You will use various establishment and maintenance techniques to meet specified requirements to provide aftercare for plants so that they are established successfully. You will also prepare crops for market.

This unit will help you progress to employment in plant husbandry in roles in the land-based sectors such as nursery worker, plant propagator, plant grower, head gardener, retailer, quality assurer, horticultural scientist and crop physiologist. You could also progress to the role of advanced apprentice or to a higher education course such as a degree in horticulture.

Learning aims

In this unit you will:

A Investigate key requirements for the commercial production of outdoor horticultural crops

B Carry out the establishment and maintenance of outdoor horticultural crops

C Use accepted working practices to carry out harvesting, grading and storage of outdoor horticultural crops.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate key requirements for the commercial production of outdoor horticultural crops	**A1** Plant suitability for outdoor horticultural crop production systems **A2** Site selection and growing systems for outdoor horticultural crops **A3** Resource requirements **A4** Factors affecting the management of plant growth and establishment	An illustrated report or presentation that researches site considerations, facilities and techniques (including the use of organics) in the management of commercial outdoor crop production for two contrasting outdoor horticultural crops, one of which meets approved organic guidelines.
B Carry out the establishment and maintenance of outdoor horticultural crops	**B1** Site preparation and establishment methods for outdoor horticultural crops **B2** Maintaining outdoor horticultural crops	Evidence of carrying out tasks in establishing, maintaining, harvesting, grading and storage of outdoor horticultural crops to meet current standards and production targets. Completion of appropriate records.
C Use accepted working practices to carry out harvesting, grading and storage of outdoor horticultural crops	**C1** Harvesting and grading of outdoor horticultural crops **C2** Maintaining the shelf life of outdoor horticultural crops	

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Content

Learning aim A: Investigate key requirements for the commercial production of outdoor horticultural crops

A1 Plant suitability for outdoor horticultural crop production systems

Categorising outdoor crops as listed below or other similar crop varieties, considering age, size and intended market.

- Plant types:
  - top fruit, including:
    - traditional fruit, e.g. apples, pears, cherries
    - specialist stone, e.g. apricot, damson
    - cider, e.g. cider apple, Perry pear
    - specialist fruit, e.g. mulberry
    - nut trees, e.g. almond
  - soft fruit, including:
    - hardy perennials, e.g. strawberries
    - bush fruit, e.g. gooseberries, blueberries
    - cane fruit, e.g. blackberry, vines
  - vegetables, including:
    - roots, e.g. beetroot
    - onions, e.g. dry bulb
    - brassicas, e.g. Brussels sprouts, cabbage
    - legumes, e.g. beans (broad, runner, dwarf), peas
    - potatoes
    - miscellaneous vegetables, e.g. asparagus, sweetcorn
  - bulbs and flowers, e.g. *Tulipa* cvs., *Helianthus annuus* and cvs., foliage.
- Types of plant production for outdoor crops, e.g. seed, seedlings, budded stock, grafted stock, bare root, containerised and container grown stock.

A2 Site selection and growing systems for outdoor horticultural crops

- Site considerations for outdoor crops:
  - soil, including structure, texture, pH, depth, fertility, drainage
  - seasonal characteristics, including drought, frost, waterlogging, rotations, cropping sequences
  - aspect, topography, exposure, protection
  - access requirements to site for growing and mechanisation
  - availability of services, e.g. mains water, drainage, electricity
  - structures, including production, potting and packing areas
  - irrigation requirements
  - relevant laws/legislation, e.g. planning regulations or Environment Act 1995
  - location of end users, including proximity to markets.
- Organic status requirements:
  - certification of organic status overseen by various bodies, e.g. organic authorities for the environment, food, rural issues, soil
  - benefits and limitations of certified status for growers, e.g. philosophy, product premium

- time and cost required to convert and availability of inputs, e.g. propagation material, growing in soil only, management techniques
- the role of soil health and fertility through various practices, e.g. use of green manures, crop rotation
- nutrient management protocols, e.g. 'acceptable/permitted', 'prior approval required' and 'never acceptable/prohibited'
- organic weed, pest and disease management, e.g. hygiene, mulching, varietal selection.

A3 Resource requirements

Establishing the requirements for production, considering the type and size for outside crops.

- Work area requirements:
  - buildings and structures for tasks, e.g. potting on and propagation, storage of plants, equipment and materials
  - tools for outside crops, e.g. forks, secateurs
  - machinery, including tractors, trailers, cultivators and harvesters
  - equipment, e.g. potting machine, grading machinery
  - materials, including containers and labels
  - information for recording purposes, e.g. computerised and manual management, cropping schedules.

A4 Factors affecting the management of plant growth and establishment

- Managing and monitoring plant growth:
  - growing space available, seed densities, spacing correctly for time of year, stage of development, shape and size of plant, thinning, pruning, trimming, providing support.
- Managing the health of crops:
  - monitoring and control of pests, e.g. insects, rodents
  - diseases, including fungal and bacterial
  - viruses and disorders, including nutrient deficiencies, climatic effects, mechanical damage, pollutants and hygiene
  - application of feed, including requirements for major, secondary and minor nutrients, top dressing, base dressing, granules, powders, liquid, slow release and fertigation.
- Factors affecting timeline planning, including:
  - natural growth times of crop
  - work schedules for planting, maintenance and harvest
  - contingency planning for production problems, e.g. adverse weather or staff absence
  - production timings of plants, seasonal marketing considerations, production costing versus pricing.
- Key principles of laws/legislation and regulations governing safe working and personal protective equipment.

Learning aim B: Carry out the establishment and maintenance of outdoor horticultural crops

B1 Site preparation and establishment methods for outdoor horticultural crops

- Preparation of growing area:
  - current soil cultivations for outdoor crops, e.g. sub-soiling and drainage, bed formation, management of soil pH
  - preparation methods, e.g. planning for sequential cropping, rotation
  - propagation methods, e.g. seeding, cuttings
  - types and sizes of containers
  - media, including peat-based, peat-free and combination mixes
  - environmental control, health and safety considerations, pest, disease and weed control
  - setting out of areas as required
  - laws/legislation covering health and safety at work and risk assessment
  - completing relevant records, e.g. propagation log, crop records.
- Selection and use of correct tools, machinery, equipment and materials for specified production tasks.
- Sowing and planting:
  - production tasks for crops during different stages of development as appropriate, e.g. preparing ground by manual and/or by mechanical means, e.g. use of robotics, planting
  - provide growing conditions to suit specified crop establishment, e.g. include light, water or spacing to suit stage of development
  - work safely, minimising damage to working area, disposing of waste correctly.

B2 Maintaining outdoor horticultural crops

- Maintenance and monitoring:
  - pruning, tidying, support and training
  - providing protection as appropriate to plant, time of year and weather conditions
  - irrigation, application of fertiliser and pinching-out
  - removing weeds, feeding and watering plants as appropriate.
- Crop health checks:
  - pests, diseases and disorders, good hygiene practices.
- Selection and use of harvest methods appropriate to plant type.
- Working safely, minimising damage to working area, disposing of waste correctly.
- Completion of appropriate records, e.g. propagation record, growing-on log, crop records to enable review.

Learning aim C: Use accepted working practices to carry out harvesting, grading and storage of outdoor horticultural crops

Harvesting and grading of crops to meet EU or other required standards.

C1 Harvesting and grading of outdoor horticultural crops

- Maturation characteristics, e.g. skin colour, size, stage of development.
- Presentation:
  - packaging and labelling that conforms to EU or other required standards
  - harvesting containers.
- Selection and use of harvesting methods.
- Waste materials and management.
- Environmental impact, e.g. water and eutrophication, energy use.
- Health and safety issues relevant to horticultural crop harvesting and grading, including:
  - safe working practices
  - potential consequences of not complying with safe working practices, e.g. injury to self or others.

C2 Maintaining the shelf life of outdoor horticultural crops

- Post-harvest handling, e.g. cleaning.
- Cooling methods, e.g. pre-cooling, air pre-cooling, vacuum cooling.
- Storage, e.g. in situ, evaporative cooling.
- Pest control and decay.
- Organisations associated with standards, e.g. linked to rural subsidies, quality of crops.
- Specialist international quality standards such as those linked to:
  - plant passports and accreditation schemes
  - marketing rules ensuring accurate labelling, products of acceptable quality and that unsatisfactory products do not reach market.
- Relevant current laws/legislation e.g.those governing marketing of fresh crops and labelling of crops.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate key requirements for the commercial production of outdoor horticultural crops		**A.D1** Assess the requirements for two contrasting commercial outdoor horticultural crops, one of which meets approved organic guidelines, evaluating the factors that affect their successful growth and development.
A.P1 Explain the requirements for the production of two contrasting commercial outdoor horticultural crops, one of which meets approved organic guidelines. **A.P2** Explain the factors affecting the management of plant growth and establishment for the production of two contrasting commercial outdoor horticultural crops, one of which meets approved organic guidelines.	**A.M1** Compare the requirements of two contrasting commercial outdoor horticultural crops, one of which meets approved organic guidelines, analysing the factors affecting their growth and establishment.	
Learning aim B: Carry out the establishment and maintenance of outdoor horticultural crops		**B.D2** Carry out, with a high degree of accuracy, tasks to establish and maintain outdoor horticultural crops.
B.P3 Competently carry out tasks to establish outdoor horticultural crops. **B.P4** Competently carry out tasks to maintain outdoor horticultural crops.	**B.M2** Efficiently carry out tasks to establish and maintain outdoor horticultural crops.	
Learning aim C: Use accepted working practices to carry out harvesting, grading and storage of outdoor horticultural crops		**C.D3** Carry out the harvesting, grading and monitoring of outdoor horticultural crops with a high degree of accuracy, evaluating the impact of growing, harvesting and storage of the crops on the quality of the final product.
C.P5 Competently carry out a crop harvesting and grading task for outdoor horticultural crops to meet objectives. **C.P6** Competently carry out an outdoor crop monitoring task to meet objectives within given storage facilities.	**C.M3** Efficiently carry out outdoor crop harvesting, grading and monitoring tasks to meet objectives, relating the results of monitoring to crop harvesting, grading, and cleaning requirements within the given storage facilities.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- appropriate, well-maintained tools and equipment and materials for carrying out production techniques
- suitable personal protective equipment (PPE)
- a range of suitable environmental-control equipment and systems
- a range of physical structures such as a greenhouse or polythene tunnel and open ground to carry out production and growing tasks
- a range of plant material for propagation, production and maintenance purposes
- for research, a library with a range of books, periodicals, brochures and catalogues, and access to the internet.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will give a comprehensive, insightful account of the production requirements of one edible and one ornamental plant, using examples of plants that have complex needs; one of which needs to meet approved organic guidelines. They will make consistently valid links between how production requirements and their timings can affect the successful establishment of outdoor horticultural crops.

Learners will carry out a thorough review of the factors that affect the management of plant growth across both edible and ornamental outdoor horticultural crops, providing valid conclusions regarding which are the most appropriate. The evidence will clearly show both breadth and depth of knowledge regarding relevant production requirements. Learners will use technical terms confidently and consistently, using the full and accurate botanical names of plants.

Learners' work will show evidence of meticulous, effective planning and a logical, effective structure of ideas and supporting examples.

For Merit standard, learners will give a detailed account of the production requirements of one edible and one ornamental plant, which have a range of different needs; one of which needs to meet approved organic guidelines. They will make mostly relevant comparisons between edible and ornamental outdoor horticultural crops and assess how timings can affect their successful establishment. The evidence will show breadth and some depth of knowledge regarding relevant production requirements.

Learners will present their work in a generally well-structured and logical way, making appropriate reference to the botanical plant names.

For Pass standard, learners will identify some of the key requirements of producing both edible and ornamental outdoor horticultural crops, using examples of plants that have quite similar needs; one of which needs to meet approved organic guidelines. They will show some breadth of understanding of the production requirements, demonstrating an appropriate but limited understanding of the timing of these. Learners will show a realistic but undeveloped understanding of the main factors that affect the establishment of outdoor horticultural crops. Their explanations may be unbalanced or generic in parts. Learners will present information with some accuracy, showing they have an understanding of some of the botanical names, although some minor omissions or inaccuracies may occur.

Learning aims B and C

Learners will individually carry out tasks in establishing, maintaining, harvesting, grading and storage of outdoor horticultural crops, including the completion of appropriate records.

For Distinction standard, learners will actively promote safety throughout the production process, taking reasonable steps within the limits of their own responsibility to ensure the safety of themselves and others, anticipating dangers and acting accordingly. They will prepare and operate tools and equipment safely and to a standard that reflects best practice in the workplace. All tasks will be conducted thoroughly, with meticulous attention to detail and according to instructions given in the task brief.

Learners will consistently demonstrate both depth and breadth of understanding regarding the potential links between a range of tasks and their effectiveness in maintaining plants and growing on post-propagation through to harvest. They will show an in-depth awareness of the impact these tasks have on the structures, facilities and integrated pest management and intended use, such as for the successional supply of food and/or flowers for the cut-flower industry. Additional secondary research will be evidenced, including the use of visits to the industry such as fruit farms, vegetable growers and/ or outdoor cut-flower suppliers.

Learners will harvest (including loading), grade and store outdoor crops safely and efficiently. They will carry out monitoring tasks with a very high degree of accuracy and make detailed, insightful suggestions regarding how crops should be stored. It is likely, but not essential, that learners will relate their suggestions to the harvesting, grading and storing tasks they carried out. Learners will consistently and accurately relate the effects of growing, harvesting and storage conditions to the quality of the crop and food safety. They will demonstrate a robust understanding of the importance of store hygiene in reducing infestations, and evaluate how such infestations can affect crop quality, and, in turn, affect food hygiene. Learners will provide specific, valid reasons that link logically to their views. They will make effective judgements about the relative importance of different aspects of crop harvesting, grading and storage, drawing on the results of their monitoring and harvesting activities. The evidence will consistently use relevant and accurate terminology that supports a considered, comprehensive response.

For Merit standard, learners will prepare and operate tools and equipment safely. Husbandry techniques will be carried out in a time-efficient and generally appropriate manner, with clear reference to the task brief. They will demonstrate breadth and some depth of understanding and knowledge of the key factors impacting on the successful establishment and maintenance of named crops.

Learners will work safely and show an awareness of potential dangers to themselves and others, within the limits of their own responsibility. They will prepare and use the required tools and equipment safely and competently. Plant maintenance tasks will be carried out in a time-efficient manner, with clear and mostly relevant reference to the brief.

Learners will harvest (including loading), grade and store outdoor crops appropriately and safely. They will monitor stored crop products accurately. They will clearly relate harvesting conditions and the results of correct grading monitoring to crop storage conditions, and will make mostly relevant suggestions regarding how these issues relate to crop quality. They will show a clear understanding of the importance of store hygiene and give mainly accurate justification for this, including reducing pest, disease or vermin infestation, but not necessarily relating the effects of infestations to long-term food safety. The evidence will make accurate use of appropriate horticultural terminology.

For Pass standard, learners must safely carry out establishment, maintenance and harvesting techniques for at least two outdoor crops. This will include risk assessing tasks. They will demonstrate some breadth of knowledge and understanding of the key factors impacting on the successful establishment and maintenance of named crops.

Learners will use appropriate personal protective equipment, such as gloves or suitable footwear. They will use required tools and equipment safely and appropriately within the limits of their own responsibility, taking reasonable steps to ensure that other personnel are not in danger from their activities, such as colleagues working closely in pruning activities, or when machinery and equipment is being used.

Edibles and ornamentals will be covered from the point of preparation of the soil, establishing plants, ongoing maintenance up to harvesting, through to the use of appropriate structures and facilities. When referring to edibles, learners could provide evidence to support the production of fruit and the successional supply of vegetables. For ornamentals, they could produce plants that would supply the cut-flower market. They will complete tasks competently, in line with the brief given to them.

Learners will harvest (including loading), grade and monitor given crops safely. They will carry out monitoring tasks with an appropriate degree of accuracy, but this will be limited in scope and might not relate harvesting and conditioning to crop quality. Learners will suggest appropriate on-site use, unloading, transportation, segregation, conditioning, grading, sorting, or cleaning requirements, as appropriate. They will demonstrate a realistic understanding of the importance of store hygiene, but will not indicate the reasons in any depth or detail. There may be some minor irrelevancies in the evidence, and some agricultural terminology may be omitted.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 7: Work Experience in the Land-based Sectors
- Unit 27: Identification, Planting and Care of Plants
- Unit 28: Routine Plant Management
- Unit 29: Plant Propagation Activities
- Unit 31: Nursery Stock Production
- Unit 33: Pests and Disease in Plants
- Unit 38: Protected Horticultural Crop Production.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops
- masterclasses involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills
- presentation and interpersonal skills when working with others
- analytical and evaluative practices when carrying out crop production
- mathematical skills and knowledge when calculating costs.

Unit 40: Zoological Horticulture

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners will investigate the horticultural practice that takes place in zoological exhibits. They will produce exhibit designs and a plan for the use and maintenance of plants in a specific setting.

Unit introduction

Many countries have a growing number of zoos, safari parks, farm parks, botanic gardens and plant conservation initiatives, which employ significant numbers of people. Within the industry, animal and plant welfare is closely linked. Zoological horticulture encompasses a wide range of activities, which require a diversity of knowledge and skills in plant selection, landscape development and management, plant–animal interactions, plant toxicity, animal browse production, propagation and cultivation skills.

In this unit, you will develop important skills and knowledge in managing plants housed in closed systems in terrestrial and aquatic environments. One of the vital roles of the horticulturalist in a zoological setting is to advise animal keepers on suitable plants, working with the zoological team on plant conservation of tropical and temperate plant species in animal exhibits. You will gain the skills needed to work collaboratively with plant and animal teams that design, create and maintain new enclosures or propagate and cultivate new plants for display and feed for animals.

This unit will help you to develop your skills in zoological horticulture and progress directly to employment in this area of the sector. It will also help prepare you for progression to higher-education programmes of study, such as a bachelor degree in plant science.

Learning aims

In this unit you will:

A Investigate the relationship between plants, animals and environmental factors in zoological exhibits

B Produce a planting design to create a suitable environment for a zoological exhibit

C Produce a horticultural management plan for a zoological exhibit.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the relationship between plants, animals and environmental factors in zoological exhibits	**A1** Plant stress, avoidance and defence **A2** Plant poisons and chemical defence **A3** Toxic species and their characteristics	An evaluation of the impact of plant toxicity in zoological exhibits. Annotated planting design for a zoological exhibit and an evaluation of its suitability.
B Produce a planting design to create a suitable environment for a zoological exhibit	**B1** Planting considerations **B2** Amenity and exhibit landscaping **B3** Plant materials for exhibits and exhibit enrichment	
C Produce a horticultural management plan for a zoological exhibit	**C1** Managing plant stock **C2** Managing plant health **C3** Research, strategies and projects for endangered plant species	A management plan for an exhibit design, focusing on implementation of the design, continued management of the plant stock and the role of conservation.

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Content

Learning aim A: Investigate the relationship between plants, animals and environmental factors in zoological exhibits

A1 Plant stress, avoidance and defence

- Abiotic and biotic plant stressors, e.g. temperature (high or low), water, salt, chemical, humidity, wind, chewing, bark stripping, digging, artificial lighting, fungi, bacteria, insects, herbivores, animal urine and faeces build-up, competition from other plants.
- Stress responses, including resistance, susceptibility, avoidance.
- Avoidance mechanisms, including morphological adaptations.
- Defence mechanisms, including thorns, prickles, spines, trichrome, colours, idioblasts, commensalism.
- Chemical defence and effects of insects and other animals, including:
  - simple phytotoxins
  - plant hepatotoxins
  - plant cardio/pulmonary toxins
  - plant neurotoxins.

A2 Plant poisons and chemical defence

- Animal indicators to plant toxicity, including lethargy, vomiting, excessive salivation.
- Structure, function and bioavailability of potential toxic agents, including alkaloids, aflatoxins, saps and unsaturated fatty acids, essential oils, sticky resins (gums or exudates, glucosinolates, milky saps (latex), acetylcholine, serotonin, histamine, cyanides, soapy saponins.

A3 Toxic species and their characteristics

Temperate and tropical toxic plant species that are toxic to some or all animals.

- Poisonous and toxic plants classification for species, including:
  - common name/s
  - Latin name
  - poisonous parts
  - level of toxicity, toxic agents, interactions with other chemicals and mode of action on living organisms
  - effects on humans, animals and other plants.
- Species toxic to animals, e.g.:
  - creeping buttercup (*Ranunculus repens*)
  - deadly nightshade (*Atropa belladonna*)
  - foxglove (*Digitalis purpurea*)
  - yew (*Taxus baccata*)
  - marsh marigold (*Caltha palustris*)
  - elderberry (*Sambucus nigra*)
  - bracken (*Pteridium aquilinum*)
  - hemlock (*Conium maculatum*)
  - laurel (*Laurus nobilis*)
  - ivy (*Hedera helix*)
  - ragwort (*Senecio jacobaea*)

- bird of paradise (*Poinciana* and related spp.)
- castor bean (*Ricinus communis*)
- oleanders (*Nerium oleander*)
- morning glory (*Convolvulaceae* spp.)
- azaleas (*Rhododendron* spp.)
- clovers (*Trifolium* spp.)

Learning aim B: Produce a planting design to create a suitable environment for a zoological exhibit

B1 Planting considerations

- Key aspects of collection planning:
  - working with zoological teams on exhibit design, maintenance, nutritional factors and accessibility
  - prioritising animal welfare when horticultural tasks impact on animal husbandry and welfare
  - maintenance and care routines of plant stock in and out of animal exhibits and aquatic environments
  - environmental conditions: temperature, humidity, urine, faeces and food waste impact, including water chemistry (nitrates, nitrites and ammonia build-up), soil pH and composition, lighting and UV spectrum impact on planted exhibits, balancing animal need for UV and plant growth requirements or plant survival requirements
  - planting scheme considerations to meet animal and visitor requirements, including:
    - maximising the potential for animal viewing, balanced with an animal's requirement for privacy and an enriched environment
    - viewing windows and platforms
    - edibility of plants and animal destruction
    - general maintenance requirements and frequency of access required
    - quantity of plants needed for planting and feed production.
- Producing a planting design for plant stock in living exhibits, including correct use of scales and basic drawing techniques.

B2 Amenity and exhibit landscaping

- Planting and maintenance of different areas in an exhibit, including:
  - temperate and tropical environments
  - herbaceous and woody stock
  - lawn, meadow
  - hedges
  - trees
  - aquatic planting in cold and tropical aquariums.
- Design and recreation of the planted habitat of different species from different world regions, e.g.:
  - arid
  - temperate forest
  - tropical forest
  - rainforest
  - arboreal

  - boreal
  - shrubland
  - wetland
  - meadow, savannah or grassland.
- Appropriate disposal methods for all vegetation, including composting, chipping, mulching.

B3 Plant materials for exhibits and exhibit enrichment

- Growth and reproduction of temperate and tropical plant stock required in zoological exhibits, including:
  - general species for enrichment across the range of species housed
  - edible species used for feeding, including browse (e.g. birch, willow, fruit trees), forages, herbs and aquatic species, e.g. duck weed (*Lemnoideae*)
  - exhibit plants to meet specific design requirements, including large trees, large shrubs and large tropical plant species.
- Use of waste plant material for zoological teams to use in exhibit enrichment.

Learning aim C: Produce a horticultural management plan for a zoological exhibit

C1 Managing plant stock

- Sourcing and procuring new plants to meet zoological team requirements, design requirements and environmental stresses, including national and international suppliers, transport logistics and requirements during transport.
- Costing and ordering new plant and miscellaneous supplies.
- Stocktaking and taking action to ensure that plants for exhibits and nutrition requirements are available as required.
- Working within budgets.
- Import and export documentation, including import licences for plants and phytosanitary certificates (plant passports).
- Housing requirements, including greenhouses, polytunnels and external housing.

C2 Managing plant health

- Regulations and laws/legislation that cover the environment, rural issues, quality of plant and animal health and seeds.
- Plant health legislation controls on the import and movement of certain plants, seeds and organic matter, including soil, fruit, potatoes, vegetables, cut flowers and foliage.
- Protection against quarantine organisms and certificates of health.
- Chemical, biological and mechanical plant controls.
- Disposal of diseased plants by burning.
- Biosecurity of waste vegetation and new plant stock going into enclosures, including biological pathogen control.
- Fertiliser use in exhibits, sustainability and potential impact on environment.
- Sustainable use of water and water-collection methods.

C3 Research, strategies and projects for endangered plant species

- Legislation and regulation of endangered plant species, including the work of:
  - Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
  - Invasive Alien Species Regulation.
- Current research into plant conservation, e.g. whitebeam, Venus flytrap, butterwort.
- Importance of interdisciplinary approach and effective communication in plant and animal conservation strategies.
- Importance of effective plant stock management and plant health management in zoological settings in supporting conservation strategies and projects.
- Communicating conservation research internally in the zoological setting and externally to the public.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate the relationship between plants, animals and environmental factors in zoological exhibits		
A.P1 Explain the significance of plant stress, avoidance mechanisms and defence strategies in plants used in zoological exhibits. **A.P2** Explain the nature and effects of plant toxicity, in different species of common plants, on animals in a zoological exhibit.	**A.M1** Analyse the nature of common plant toxins and how they impact on animals in a zoological exhibit.	**A.D1** Evaluate the impact of plant toxicity on animals in a zoological exhibit.
Learning aim B: Produce a planting design to create a suitable environment for a zoological exhibit		
B.P3 Produce a planting design for a basic zoological exhibit. **B.P4** Explain the suitability of own zoological design.	**B.M2** Produce a detailed planting design for a complex zoological exhibit. **B.M3** Analyse the suitability of own planting design for a complex zoological exhibit.	**B.D2** Produce a comprehensive planting design for a complex zoological exhibit, evaluating the suitability of own planting design.
Learning aim C: Produce a horticultural management plan for a zoological exhibit		
C.P5 Produce a basic plan for managing plant stock and health in a zoological exhibit. **C.P6** Explain the role of plant conservation in a zoological exhibit.	**C.M4** Produce a detailed plan for managing plant stock and health in a zoological exhibit. **C.M5** Analyse the importance of plant conservation in a zoological exhibit.	**C.D3** Produce a comprehensive plan for managing plant stock and health in a zoological exhibit, evaluating the role of plant conservation on the overall success of the zoological exhibit.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, B.M3, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M4, C.M5, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- the centre's own zoological collections or external zoological collections
- a range of suitable tropical and temperate plant species
- technical drawing and measuring equipment
- a suitable laboratory.

Essential information for assessment decisions

Learning aims A and B

In achieving learning aims A and B, learners are required to individually produce a planting design for a zoological exhibit. The design must focus on **one** of the following types of enclosure: arid, temperate forest, tropical forest, rainforest, arboreal, boreal, shrubland, wetland, meadow, savannah or grassland. The design should include annotations such as labelling and keys.

For Distinction standard, learners will produce a comprehensive design using appropriate techniques, including scales. The design will cover an enclosure using a mixture of plant species, supported by well-reasoned justifications for plant choice and suitability, with no irrelevancies. Learners will evaluate the effectiveness of the planting schemes in the design, giving robust evaluation of the required considerations for the chosen plant stock and landscaping. The evaluation will show breadth and depth in the application of knowledge and understanding of plant avoidance, stress, defence strategies, structure, function and bioavailability of plant toxins, toxicology of relevant species of plants and the impact they can have on different species of animal, relevant to the design. Learners will make entirely valid, accurate connections between the plant characteristics, care and maintenance requirements and the impact of plants on animal species in the specific design. They will produce a design of a very high standard. Learners will show breadth and depth of understanding in the use of annotations, labelling and design keys. They will use appropriate terminology consistently and accurately throughout the design.

For Merit standard, learners will produce a detailed design using appropriate techniques, including scales and covering an enclosure using a mixture of plant species. They will provide clear, logical reasons for plant choice and suitability. They will analyse planting schemes and landscaping materials within the zoological enclosure design, with clear considerations for the plant stock chosen. Evidence will show breadth and some depth in the application of knowledge and understanding of plant avoidance, stress, defence strategies, structure, function and bioavailability of plant toxins and toxicology of relevant species of plants, and the impact they can have on different species of animal relevant to the design. Learners will make mostly clear, relevant connections between plant characteristics, care and maintenance requirements, and the impact of plants on animal species in the specific design. They will show appropriate application of skills in producing a complex design, with breadth and some depth of understanding in the use of annotations, labelling and design keys. Learners will use appropriate terminology throughout the design.

For Pass standard, learners will produce a basic, realistic design, using appropriate techniques, including scales and covering an enclosure using a mixture of plant species. They will provide realistic reasoning for plant choice and suitability, although this is likely to be limited in scope. Learners will evidence some relevant analysis of planting schemes and landscaping materials in the zoological enclosure design. It is, however, likely to be generalised and lack specific, substantiated links between relevant factors in a zoological exhibit. Learners will show some breadth and depth in the application of knowledge and understanding of plant avoidance, stress, defence strategies, structure, function and bioavailability of plant toxins and toxicology of relevant species of plants, and the impact they can have on different species of animal relevant to the design. Learners will make realistic but undeveloped connections between plant characteristics, care and maintenance requirements, and the impact of plants on animal species in the specific design. They will demonstrate skills in producing a basic but appropriate design, with mostly accurate use of annotations, labelling and design keys.

Evidence will show some use of relevant terminology but there may be omissions.

Learning aim C

In achieving learning aim C, learners must individually produce a management plan for implementing the design produced for learning aims A and B. The management plan must include management of plant stock included in the design.

For Distinction standard, learners will demonstrate in-depth knowledge and understanding of plant care, maintenance and logistics through a meticulously developed management plan for the completed design. Learners will show a robust understanding of best practice and of the wider implications for plant choice by evaluating the importance of managing plant stock and health comprehensively, ensuring sustainability and that the horticulturalist sources plant stock from reputable suppliers responsibly. The management plan will evidence in-depth understanding of the processes required: implementation, sourcing, procuring, costing and ordering of new plants (including a budget). Valid references will also be made to the process of meeting integrated legislation and regulation requirements of importing plants from other countries. Learners will provide balanced, insightful views of the significance of plant conservation strategies and projects for species in exhibits. They will also show comprehensive understanding of the role of communication across zoological teams. They will use appropriate technical language consistently and accurately throughout the plan.

For Merit standard, learners will demonstrate detailed knowledge and understanding of plant care, maintenance and logistics through a clear, detailed management plan for the completed design. They will show understanding of the wider implications for plant choice by analysing the importance of managing plant stock and health. There will also be clear, relevant references to achieving sustainability and the importance of the horticulturalist's responsibility to source plant stock from reputable suppliers.

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The management plan will demonstrate breadth and some depth of understanding of the processes required: implementation, sourcing, procuring, costing and ordering of new plants (including a budget). Mostly accurate references will also be made to compliance with integrated legislation and regulation requirements for importing plants from other countries. Learners will make mostly logical references to the role of plant conservation strategies for species in exhibits, the importance of communication across zoological teams. Learners will use appropriate technical language throughout the plan but it may be inconsistent.

For Pass standard, learners will demonstrate realistic but basic knowledge and understanding of plant care, maintenance and logistics through a competent management plan for the completed design. Learners will show some relevant understanding of the wider implications for plant choice in considering the importance of managing plant stock and health, ensuring sustainability and that the horticulturalist sources plant stock from reputable suppliers responsibly. Learners will demonstrate limited depth and breadth of understanding of design implementation. The management plan will show some relevant, realistic understanding of the processes required at a basic level: implementation, sourcing, procuring, costing and ordering of new plants (including a budget). Learners will also consider the need to comply with the integrated legislation and regulation requirements of importing plants from other countries. The evidence will include realistic but limited awareness of plant conservation strategies and projects for species in exhibits, communication across zoological teams.

Links to other units

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 7: Work Experience in the Land-based Sectors
- Unit 27: Identification, Planting and Care of Plants
- Unit 28: Routine Plant Management.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops
- masterclasses with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- practical application when reflecting on the impacts of plant toxicity.

Unit 41: Wildlife Ecology and Conservation Management

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners study the methods and skills needed to investigate habitats and to carry out wildlife habitat improvements and wildlife rehabilitation.

Unit introduction

Wildlife responds to changes in its habitat. Good animal management will be able to assess those changes, plan habitat improvements and carry them out for the benefit of the wildlife. Sometimes it may be necessary to rehabilitate wildlife. This unit will give you the practical skills you need to carry out a range of wildlife habitat and rehabilitation tasks.

You will learn how to survey and assess habitats in relation to wildlife needs, develop and follow a plan for improvements, and monitor the outcomes. You will also learn to assess wildlife for rehabilitation – for example following loss of habitat through development – and create and follow a plan to reintroduce the wildlife to a suitable habitat.

Whether you move into employment or to further study, the skills you develop in this unit will be invaluable. The study of wildlife and habitat is essential for good animal management. It is an integral part of a wide variety of careers, including conservation and environmental monitoring and planning.

Learning aims

In this unit you will:

A Understand the characteristics of ecosystems for wildlife habitat planning and rehabilitation

B Carry out field studies into wildlife populations and their habitats for the purpose of planning for wildlife management

C Undertake practical wildlife and conservation management to affect biodiversity.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Understand the characteristics of ecosystems for wildlife habitat planning and rehabilitation	**A1** Distribution of ecosystems **A2** Relationships in ecosystems **A3** Human interactions with ecosystems	A portfolio of evidence, such as maps, diagrams, flow charts and reports from investigative fieldwork.
B Carry out field studies into wildlife populations and their habitats for the purpose of planning for wildlife management	**B1** Habitat surveys for wildlife management **B2** Monitoring wildlife populations **B3** Planning for wildlife habitat management and rehabilitation	A survey report, using survey, monitoring and other research information to develop animal- and habitat-specific plans to manage a wildlife population, including maps, task lists, cost–benefit analysis and schedules. Evidence that demonstrates management tasks for habitat change and rehabilitation, which could be a photo log, signed witness statements and/or observation record(s).
C Undertake practical wildlife and conservation management to affect biodiversity	**C1** Interpretation of habitat management and wildlife rehabilitation plans **C2** Carrying out practical habitat management and wildlife rehabilitation **C3** Monitoring the outcomes of practical habitat management and wildlife rehabilitation	

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Content

Learning aim A: Understand the characteristics of ecosystems for wildlife habitat planning and rehabilitation

A1 Distribution of ecosystems

- Geographical distribution of ecosystems:
  - scale of ecosystems, including biome, habitat, microhabitats and ecological niches
  - standard methods of mapping and classification, e.g. Phase 1 survey methodology and nomenclature.
- Factors affecting the distribution of ecosystems:
  - abiotic factors that influence the distribution of ecosystems at a range of scales, including global (e.g. atmospheric energy flows and climate zones), regional (e.g. distance from the sea and altitude), local (e.g. aspect and soil type) and micro (e.g. shade and slope)
  - biotic factors, including the modifying influence of plant, animal and human activity.
- Characteristics of major land biomes and habitats:
  - world biomes, to include the five major types: aquatic, desert, forest, grassland and tundra
  - common habitats, to include coastal, lowland grassland and heathland, freshwater and lowland wetlands, upland, woodland
  - characteristics, to include altitude, latitude, distance from the sea, rainfall, wind speed and direction, temperature, aspect, soil type, fauna and flora.

A2 Relationships in ecosystems

- Energy flows in ecosystems:
  - the flow of energy through an ecosystem, including energy loss, e.g. through respiration and excretion
  - trophic levels, food chains and pyramids
  - natural cycles, including carbon, nitrogen, oxygen, phosphorus and water.
- Wildlife in ecosystems:
  - relationships between animals and other species (including plants), to include predator/prey, symbiosis and parasitism
  - interactions in ecosystems to provide for animal needs, e.g. food, shelter, protection, migration, reproduction and competition.

A3 Human interactions with ecosystems

- Human impacts on ecosystems:
  - impact of human activities, including positive, negative, historical, present and future, e.g. woodland clearance, organisations linked to forests, economic policies linked to agriculture
  - main threats to ecosystems at global, national and local scales, e.g. climate change, depletion of fish stocks and tree dieback.
- Protection and conservation strategies:
  - the use of planning and other environmental legislation
  - funding for habitat stewardship
  - the role of charitable and volunteer organisations
  - rehabilitation of wildlife and its impact on biodiversity, including licensing of rehabilitation
  - the range of conservation strategies, e.g. catch and release, captive breeding, maintaining genetic diversity, habitat management.

Learning aim B: Carry out field studies into wildlife populations and their habitats for the purpose of planning for wildlife management

B1 Habitat surveys for wildlife management

Methods and considerations required to carry out habitat surveys:

- planning a survey, choice of survey area, equipment
- sampling techniques, e.g. random, systematic, stratified
- health and safety considerations, e.g. lone working, working near water and use of personal protection equipment (PPE), e.g. in dense undergrowth
- survey techniques, e.g. quadrat, transect, kick methodologies
- recording of results, e.g. tally charts and mapping, including field use of ICT.

B2 Monitoring wildlife populations

Methods and considerations required to carry out the monitoring of wildlife populations:

- planning animal monitoring or population surveys, e.g. equipment, scheduling, methodology
- direct methods, including catch and release, estimation techniques, e.g. of bird populations
- legislation, including health and safety, licensing of live capture programmes
- indirect, non-invasive methods, including tracks and signs, use of tracking tunnels, moving transects, e.g. butterfly walks
- recording and reporting of data.

B3 Planning for wildlife habitat management and rehabilitation

Developing a rehabilitation or habitat plan for targeted wildlife species:

- using survey data to develop a species and habitat plan with measurable outcomes
- task allocation and schedules, taking into account, e.g. seasonality of operations
- tools, materials and equipment used for practical tasks, including suitable general tools (e.g. billhooks, bowsaws) and species-specific tools (e.g. nesting boxes)
- health and safety considerations, including compliance with relevant legislation
- use of monitoring programmes to evaluate outcomes, e.g. species counts, marking, clay pads
- assessing the viability of rehabilitating specific wildlife in terms of survival and recovery
- developing a species-specific rehabilitation plan to include standard release factors that influence a successful outcome
- the development of monitoring strategies that will enable the success of rehabilitation to be evaluated.

Learning aim C: Undertake practical wildlife and conservation management to affect biodiversity

C1 Interpretation of habitat management and wildlife rehabilitation plans

Implementing habitat and rehabilitation plans:

- translating plans into tasks
- scheduling, taking account of seasonality
- job specifications
- identification of tools, materials and equipment
- ordering materials
- risk assessments
- identification of relevant legislation, codes of practice and licensing
- identifying skill sets, e.g. suitably qualified chainsaw operators.

C2 Carrying out practical habitat management and wildlife rehabilitation

Safe completion of planned tasks required to manage project, including:

- task allocation
- time management
- correct selection, transport, use, maintenance and storage of tools, materials and equipment
- working safely, assessing risks
- compliance with relevant legislation, codes of practice and planning guidelines
- minimising environmental damage and disturbance.

C3 Monitoring the outcomes of practical habitat management and wildlife rehabilitation

Determining the impact of practical habitat management and rehabilitation:

- reporting the outcomes of practical habitat management and rehabilitation
- measuring actual outcomes against predicted outcomes, e.g. increase or decrease in target species or survivability
- use of monitoring programmes to track outcomes, e.g. use of equipment to track population change
- analysis of strengths and weaknesses
- opportunities for improvement, e.g. extending the area of habitat improvement.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Understand the characteristics of ecosystems for wildlife habitat planning and rehabilitation</td><td rowspan="2">A.D1 Evaluate human impacts on wildlife ecosystems and the range of responses to mitigate or enhance those impacts.</td></tr>
<tr><td>A.P1 Explain the distribution of ecosystems.
A.P2 Explain different relationships within ecosystems.</td><td>A.M1 Analyse the relationships between named animal species and their interactions with their habitats.</td></tr>
<tr><td colspan="2">Learning aim B: Carry out field studies into wildlife populations and their habitats for the purpose of planning for wildlife management</td><td rowspan="4">BC.D2 Justify a specific habitat or rehabilitation plan using survey and monitoring data.
BC.D3 Evaluate the impact of the rehabilitation plan and tasks carried out on biodiversity and the wildlife habitat.</td></tr>
<tr><td>B.P3 Perform wildlife habitat surveys and monitor wildlife populations.
B.P4 Prepare a clear located habitat management or rehabilitation plan for a named animal, using the findings of habitat and animal population surveys.</td><td>B.M2 Analyse survey and monitoring data to produce, for a named animal species, a located habitat management or rehabilitation plan.</td></tr>
<tr><td colspan="2">Learning aim C: Undertake practical wildlife and conservation management to affect biodiversity</td></tr>
<tr><td>C.P5 Demonstrate the proficient completion of habitat management tasks in accordance with an agreed plan.
C.P6 Demonstrate, under supervision, wildlife rehabilitation in accordance with an agreed plan.</td><td>C.M3 Demonstrate appropriate techniques for habitat management and wildlife rehabilitation, adapting techniques for changing circumstances.</td></tr>
</table>

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, BC.D2, BC.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a range of habitats suitable for detailed survey work
- wildlife animal species suitable for population studies
- a licensed animal rehabilitation programme.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will show a depth of understanding by evaluating how human impacts on ecosystems can be both positive and negative. They will apply knowledge to less familiar situations and include impacts at a variety of scales and from different historical periods. Their evaluation will be based on properly referenced case studies and will include original fieldwork. Learners will be able to demonstrate the complexity of human impacts and include both intentional and unintentional outcomes. They will show through their analysis that cost–benefit factors can influence outcomes.

Learners will show that they understand that planned outcomes are often difficult to predict and that the scientific basis for decision making can be ambivalent, for example when examining wildlife culls.

Learners will justify their conclusions by linking impacts to the change or breakdown of specific relationships through human intervention, rather than by explaining them in general terms.

For Merit standard, learners will demonstrate their understanding of specific named habitats and species. Learners will show clearly the relationships between different species, including both the nature of the relationship and the energy flow demonstrated. They will make reasoned, analytical judgements, showing that they understand how the habitat provides for the needs of the animal, and applying their knowledge to less familiar situations. For example, plants that are preferred nesting material and/or food source for a mammal.

For Pass standard, learners will recall knowledge to explain basic world biomes and common habitats. They will include the ways in which biotic and abiotic factors control the distribution of habitats, and demonstrate awareness that these factors can operate on the very smallest scales. Learners will include specific examples, referring to well-defined situations in order to demonstrate understanding. They will relate natural cycles to specific plant and animal species and to named habitat examples.

Learners will demonstrate their understanding of the different relationships in ecosystems – including energy flows, wildlife and the impact of humans – exploring well-defined situations and structuring their knowledge in order to reach suitable conclusions.

Learning aims B and C

For Distinction standard, learners will be able to articulate arguments concisely and professionally in order to justify their habitat management or wildlife rehabilitation plan. They will be able to relate their plan to measurable outcomes and should describe a monitoring plan to use detailed analysis and research in order to justify recommendations made in the plan. Their rationale should be based on relevant primary data, supported with additional, referenced research.

Learners will confidently show that their plan will address specific relationships between the target species and its environment. For example, planting shrub coppice can provide mid-layer transport pathways, overhead cover from predators and a valuable food source for mice.

Learners will draw on knowledge from across the learning aims to reflect on the success of their plan and the tasks they have undertaken. They will use detailed analysis to make objective judgements on both the process and product of the tasks. Learners will predict the impact their tasks will have on the wildlife environment and, specifically, the relationships between the target species and its environment. They will also show awareness of the difficulty of making definitive predictions.

Learners will demonstrate awareness that the tasks they have undertaken may have negative impacts on the target species and other relationships in the environment; for example, rehabilitation of a predator species may alter the equilibrium of the environment. Improvements identified should include better ways of working, as well as improved outcomes.

For Merit standard, learners will make reasoned, analytical judgements on the outcomes of their surveys and produce a located plan for habitat improvements or rehabilitation based on their analysis. The plan should detail the tasks required, as well as identifying appropriate solutions and explaining how these tasks will impact on one or more named target animal species.

Learners will select appropriate solutions in order to react to changing circumstances during the completion of tasks, identifying these solutions from practical exploration. Where tasks need to be modified, learners will be able to modify techniques to ensure that the agreed outcomes will still be realised.

For Pass standard, learners will select and competently demonstrate a range of appropriate survey techniques, targeting specific animal species and their habitats. They will carry out survey techniques correctly and safely. The surveys must be species specific, for example surveying the amount of plant material used as bedding by mice. Learners should be similarly competent in investigating wildlife populations, although it is unlikely that this will be carried out through licensed catch and release methods unless undertaken as part of an authorised programme. More appropriate will be the use of direct observation, for example population counts, good identification of tracks and signs, tracking tunnels and other less invasive methods. Recording of data will be comprehensive and accurate, and findings will be presented in an appropriate format, including, for example, graphs, tables and maps.

Learners will select and demonstrate competent practical skills for both habitat improvement and wildlife rehabilitation. They will show that they can work safely and efficiently, and with due regard for other people, animal welfare and the environment. The correct and safe selection, transport and use of tools, materials and equipment is essential.

For rehabilitation, learners will act under supervision to ensure good animal welfare. For all of the practical tasks, learners will be expected to show that they can minimise environmental impacts.

Links to other units

This unit links to *Unit 7: Work Experience in the Land-based Sectors*.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- opportunities for observation during work experience
- support from local land-based organisation staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research and analysis skills through investigation of human impacts on ecosystems
- evaluative and developmental skills
- practical application when tracking wildlife
- safe working practices and procedures when managing habitats.

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Unit 42: Landscape and Garden Design

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills needed to carry out site evaluations to prepare to meet client briefs and to produce planning documentation based on their site evaluations.

Unit introduction

Well-designed landscapes and gardens can transform an environment and many are popular tourist destinations. Skilled landscape and garden designers are in demand. Organisations such as local authorities and hard and soft landscaping companies, and individuals such as head gardeners, need designers with the skills to assess environments and make informed decisions that will meet client needs.

In this unit, you will focus on the background requirements that a designer must know about and the roles of both the client and the designer. You will learn about the legislation relating to design development and the supporting documentation that is needed. You will develop graphic design skills to communicate analytical research. You will learn how to appraise a site's potential in order to meet a client's requirements and about the design process needed to produce a design proposal plan that can be implemented for a landscape and garden design. You will develop your presentation skills, carrying out research on the factors that influence the evolution of a landscape and garden design, and identify design solutions to meet the client's needs, expectations and requirements.

Completion of this unit will help you prepare for employment in roles such as head gardener and landscapes manager (hard and soft). You could also progress to a higher-education course such as a degree in landscape and garden design or landscape architecture.

Learning aims

In this unit you will:

A Examine the key information required to produce a landscape and garden design brief

B Carry out a site evaluation to meet a client brief in preparation for landscape and garden design

C Plan a landscape and garden design to meet a client brief.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Examine the key information required to produce a landscape and garden design brief	**A1** Client needs analysis **A2** Legal requirements **A3** Key documents	Report detailing the information that a designer needs from a client and the legal and contractual issues that need to be taken into account.
B Carry out a site evaluation to meet a client brief in preparation for landscape and garden design	**B1** Site inventory and analysis of characteristics and issues **B2** Site appraisal	Portfolio of evidence that includes: • evidence of the learner carrying out a site analysis • site appraisal based on the findings of the site analysis • completed design plan to meet the needs of a client.
C Plan a landscape and garden design to meet a client brief	**C1** Design principles and layout **C2** Design development methods **C3** Design proposal plan and presentation	

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Content

Learning aim A: Examine the key information required to produce a landscape and garden design brief

A1 Client needs analysis

Development of a client profile that will aid interpretation of their needs.

- Composition of a client brief questionnaire:
  - impact of questions and the selection process required, e.g. leading, probing, open and closed questioning techniques
  - contributing factors that a client brief questionnaire needs to identify to include design style, budget, intended use and plant preferences to inform accurate interpretation to meet the client requirements
  - development of a layout and styling of a client brief to influence engagement, e.g. professionalism, corporate identity, easy and simple to navigate through.
- Managing client expectations of the brief:
  - client needs, desires and expectations: exploration of the variables and their effects on design development
  - interpretation of needs through client's response to questions, e.g. disabled access, utilities and maintenance levels
  - impact of client expectations on influencing design choices
  - exploring the client's design desires through interpretation, suitability and reality to include budget, legal or planning restrictions and site opportunities or constraints.

A2 Legal requirements

National and local legislative conditions and restrictions that influence design choices.

- Access and egress:
  - rights of way in and out of a site: cost implications, agreement conditions and permissions through contract
  - changes of access to a site: impact of consideration made for temporary or permanent adjustments, e.g. conservation areas, covenants and land ownership.
- Boundaries:
  - identification of ownership, responsibilities and rights
  - implications on maintenance of boundaries that are shared, owned or adjoining client's property, e.g. overhanging trees/hedge, party wall or access to boundary repairs/replacement/maintenance
  - impact of legislation on the installation and specification of boundaries to include height restrictions, proximity to highways and local restrictions.
- Legal restrictions in planting and maintenance of trees:
  - impact of Tree Preservation Orders or similar on design decisions to include the impact on maintenance, construction and removing without permission
  - key considerations in the selection of trees and their proximity from the property, e.g. negligence, rights to light and subsidence
  - impact of tree roots on services, surfaces and structures.

- Planning permission requirements:
  - impact of conservation areas on design choices, e.g. tree works, styling and use of structures
  - implications of house grade listings
  - installation and specification of structures and features within the design, e.g. location, height and styling.
- Utility services: identification of utilities, their location and mapping of underground and overground services.

A3 Key documents

Garden designer professional practice documentation.

- Management and communication of services:
  - explore the designer's and client's responsibilities, e.g. terms and conditions
  - letter to client outlining services and fees, including a statement of service and fees and a form of agreement between client and designer
  - initiation of design commission, e.g. establishing services required, scope of works with deadlines and bringing an agreement to an end
  - provision of all permissions and legal documentation, e.g. Tree Preservation Order (TPO) works and variations, change of access and insurance documentation
  - impact of record-keeping documentation on effective project management.

Learning aim B: Carry out a site evaluation to meet a client brief in preparation for landscape and garden design

B1 Site inventory and analysis of characteristics and issues

Interpretation of a site's potential to meet client needs.

- Existing site features:
  - identification and mapping of all fixed-site features to include buildings, structures, perimeters, existing vegetation and services
  - utilities and services within the site, e.g. water, electricity, mains waste
  - mapping of existing garden layout, including access, level changes and listing of landscape materials.
- Site analysis:
  - qualitative analysis of existing features, including the current effectiveness of the features, recycling potential of materials, value of views in and out of the site, circulation and maintenance requirement
  - collation of non-physical elements, e.g. prevailing wind, aspect of shade and sun and noise pollution
  - exploration of topography, e.g. frost pockets, suntrap and dry/wet soil conditions
  - soil type and its suitability for plant selection, including effects on soil from existing plants
  - composition of analytical information as a plan to inform and direct design solutions, including the use of graphics to provide visual communication, annotation and photographs.

B2 Site appraisal

Linking client requirements to the site's potential.

- Site appraisal:
  - exploration of a site's potential to accommodate client needs, desire and expectations
  - interpretation of site analysis process to identify opportunities and constraints within the site
  - development of appraisal plans, including use of graphics, images and annotations to inform and evaluate design.

Learning aim C: Plan a landscape and garden design to meet a client brief

C1 Design principles and layout

Influences on and interaction of design principles in effective landscape and garden design.

- Design principles:
  - human scale in the environment and the impact of its manipulation
  - influences of a site's internal and external environment on proportion development, e.g. grid system linked to property, height of trees or borrowed views and surrounding structures
  - contribution of emphasis, balance and rhythm in the development of engaging spaces and journeys through a designed garden
  - evolution of design unity, using an arrangement of design principles
  - drawing techniques
  - exploration of line: capture of nature and form in developing freehand drawing techniques
  - texture, e.g. shade, pattern, proportion and shape.

C2 Design development methods

- Function plan development:
  - exploration of appraisal findings to make informed choices in terms of space allocation
  - identification of voids and the use of function plans (bubble diagrams) to develop interaction using specific graphics, to include voids, focal point, circulation hierarchy and screening
  - identification of masses and their impact on voids
  - methods of annotation and labelling of plans to communicate
  - garden design styles
  - identification of characteristics of different styles through their features, plants and functionality
  - exploration of styles that meet the needs of the client and site.
- Form plan development:
  - development of form drawings and the interaction with the chosen function plan
  - range of angles in isolation or in combination to develop bespoke form plans, e.g. 90°, 45°, 30/60° and radial
  - composition of simple detailing graphics for identification of planting areas, surface types, features and materials
  - material types and features to impart the styling of the design.

- Sketch design:
  - scaled plan that refines and details the design concept, including the use of line and the necessary tools to develop a plan
  - British standard layouts and custom layouts for creative and professional plan presentation
  - composition of a design with materials, structures and features drawn to a suitable metric scale
  - graphics development that provides a range of elements and which includes paving materials, furniture, planting areas and topography
  - use of labelling and annotation in making the design clear to the client
  - use of text types, key and title block in making the design clear and effective
  - health and safety, e.g. minimising risk in construction, maintenance and everyday use
  - collation and composition of ideas for the mood of the garden, to include features, planting styles, furniture and materials.

C3 Design proposal plan and presentation

- Design proposal plan:
  - high-quality graphics to clearly communicate all material selections, plant forms, structure composition and styling
  - line hierarchy – use of line thickness variation to demonstrate level or height to compose depth within a plan.
- Detailing of a feature or element to clearly communicate to client and contractor, e.g. elevations, construction detailing and three-dimensional drawing.
- Annotations and labels to specify key elements in detail, e.g. boundary heights and materials, colour themes, product specification and furniture.
- Professional layout of borders, title block, key and information panel with clear line work using a range of drafting equipment, e.g. compass, scale ruler, French curves and ink pens.
- Presentation techniques to communicate effectiveness of a design to meet a client's needs:
  - production of annotated plans with supporting documentation, e.g. printed design proposal plan, mood board/digital image library and catalogues/brochures
  - exploration of three-dimensional composition, e.g. axonometric, isometric and basic CAD program.

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Assessment criteria

Pass	Merit	Distinction
Learning aim A: Examine the key information required to produce a landscape and garden design brief		
A.P1 Explain requirements using a questionnaire that identifies client needs for a landscape and garden design. **A.P2** Explain legal and contractual factors relevant to the production of a landscape and garden design.	**A.M1** Assess client, legal and contractual requirements for the production of a landscape and garden design.	**A.D1** Evaluate client, legal and contractual requirements for the production of a landscape and garden design.
Learning aim B: Carry out a site evaluation to meet a client brief in preparation for landscape and garden design		
B.P3 Perform simple site analysis, presenting findings. **B.P4** Produce a basic site appraisal based on the results of own site analysis.	**B.M2** Perform a complex site analysis, presenting clear findings. **B.M3** Produce a detailed site appraisal based on an assessment of findings of own site analysis.	**B.D2** Produce a complex site appraisal based on an evaluation of the findings of own complex site analysis.
Learning aim C: Plan a landscape and garden design to meet a client brief		
C.P5 Plan a simple landscape and garden design to meet a client brief. **C.P6** Explain landscape and garden design decisions.	**C.M4** Plan a complex landscape and garden design to meet a client brief, evidencing reasoned decision making.	**C.D3** Plan a complex landscape and garden design to meet a client brief, providing a detailed rationale for approaches taken.

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, B.M3, C.M4, B.D2, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- land-based library and internet resources
- a surveyed landscape or garden
- drafting boards
- access to PCs
- drafting equipment.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will carry out a comprehensive investigation into questionnaire development and question types. Learners will provide a detailed account of the type of information that needs to be extracted from the client to inform the designer, e.g. existing features to retain or remove, proposed timescale and proposed services requirements. To ensure a professional standard, learners will evaluate the suitability of question types and demonstrate robust consideration of layout and composition of the questionnaire.

Using the questionnaire, learners will produce a comprehensive record of information from the client or a written brief and engage in detailed discussion to further their knowledge of the client's requirements. Learners will make accurate and evaluative decisions to identify the client needs, desires and expectations.

Learners will conduct accurate and in-depth secondary research into two legal considerations that may affect garden design choices. Learners will demonstrate breadth and depth of knowledge and understanding of the influences and effects that these laws and regulations have on designing landscapes and gardens.

Learners will consider professional practice documentation in detail. Using secondary research, learners will evaluate the effectiveness of standard documentation and suggest how it could be adapted, demonstrating in-depth knowledge and understanding of client and designer roles and responsibilities. Learners will provide a comprehensive, consistently logical account of services, fees and contractual obligations to achieve a garden design proposal plan.

For Merit standard, learners will carry out a detailed investigation into questionnaire development and question types. Learners will identify the types of information required from the client, e.g. design style, plant preferences, garden feature requirements. Learners will assess the suitability of question types and produce a well-structured questionnaire.

Using the questionnaire, learners will produce a detailed, clear record of information from the client or a written brief, and engage in generally relevant discussion to further their knowledge of the client's requirements. Learners will make accurate and mostly relevant decisions to identify client needs, desires and expectations.

Learners will carry out detailed secondary research into two legal considerations that may affect garden design choices. Learners will demonstrate appropriate knowledge and understanding of the influences and effects that these laws and regulations have on designing landscapes and gardens.

Learners will consider professional practice documentation in some detail. Using secondary research, they will make mostly relevant recommendations as to how the documentation could be adapted, demonstrating knowledge and understanding of client and designer roles and responsibilities. Learners will provide clear details of services, fees and contractual obligations to achieve a garden design proposal plan.

For Pass standard, learners will provide a basic list of suitable questions that demonstrate some understanding of question types needed to generate client information. A simple questionnaire layout will be adopted, showing a limited but mostly appropriate understanding of selected question order and priorities.

Using the questionnaire, learners will produce basic, realistic information from the client or written brief. They will demonstrate limited understanding in their interpretations of client needs, desires and expectations, identifying some of the main requirements.

Learners will carry out basic research into two legal considerations. Their research will demonstrate limited knowledge and understanding of the influence and effects these laws and regulations have on a landscape and garden design. Learners will demonstrate some understanding of potential issues if legislative regulations are not adhered to.

Learners will consider professional practice documentation using simple standard templates and show basic understanding of client and designer responsibilities. Learners will provide simple lists of services and fees, with some references to scope of work linked to meeting the design proposal plan. Learners will carry out basic secondary research, although this will be limited in scope.

Learning aims B and C

Learners must individually carry out a site analysis. They will individually produce a site appraisal and design proposal.

For Distinction standard, learners will conduct a comprehensive investigation of a given landscape or garden to produce accurate and detailed findings of the site analysis, using effective communicative graphics and annotations. To identify current effectiveness, learners will demonstrate knowledge and understanding of qualitative interpretation of site elements, features and the surrounding environment.

To identify opportunities and constraints, learners will review interrelationships between the client's requirements and the site analysis. Learners will produce a comprehensive, logical site appraisal plan. They will demonstrate both depth and breadth of knowledge and understanding of how influencing factors have informed design choices that will support the client's needs and optimise effective use of the site.

Learners will produce and develop a comprehensive range of function and form plans that explore design options in depth. They will identify one function plan to meet client requirements. Learners will demonstrate effective understanding of design principles in the composition of form plans.

Learners will provide a detailed review that evaluates the suitability of one form plan to develop into a sketch design that is to scale. Learners will research potential materials and features meticulously, using scaled representational graphics. Effective use of design principles will be applied in a professionally drafted sketch design using custom title block, key and border and detailed annotations that demonstrate client requirements and site suitability being met.

Learners will produce a professionally composed and drafted design proposal plan in ink, printed copy and colour rendering. Learners will demonstrate depth of understanding of line hierarchy used in structures and planting areas, and effective, accurate use of design principles in the composition of their design. Evidence of discussion will inform further development and enhancement of the design.

As part of a report or presentation on the development of the design, learners will produce detailed elevation or three-dimensional images in a variety of media, with well-justified reasons for their design choices and approaches. Clear and realistic detail about the interrelationship between client requirements and site analysis will be discussed and evidenced.

For Merit standard, learners will carry out a detailed investigation of a given landscape or garden. Learners will identify and analyse a broad range of existing features. They will give a clear analysis of the quality and contribution of these features to the landscape or garden. Learners will produce a well-composed record of their findings, using researched graphics and giving mainly relevant consideration to some external environmental factors. Learners will demonstrate some knowledge and understanding of qualitative interpretation of existing features.

Learners will use the site analysis findings and interpretation of the client brief to produce a detailed site appraisal plan, identifying site opportunities and constraints. Learners will show mostly relevant knowledge and understanding of influencing factors that inform decisions needed in order to meet client requirements.

Learners will produce a broad range of function plans, showing detailed consideration of the informed design choices identified in their site appraisal plan. One function plan will be identified for its suitability to meet client requirements and site potential to develop a form plan. Learners will show a clear understanding of design principles in their composition.

Learners will review, in detail, the suitability of the options available and select one form plan to develop into a well-drafted sketch design that will be composed to scale. Learners will apply design and complete all aspects of the design and layout requirements to custom borders, titles and use of key. To demonstrate that client requirements and site suitability are being met, learners will give annotations for all elements.

Learners will carry out discussions to inform further design development and to produce a detailed design proposal plan, completed in ink, printed copy and simple colour rendering. Learners will demonstrate simple use of line hierarchy, detailed plant and material graphics in association with the application of design principles within their design. Learners will produce a detailed account of the design and plant styling, including materials and structures being used.

Learners will produce a report or presentation that clearly identifies the key influences on the development of their design, to include the site analysis and client requirements. Learners will give mostly valid reasons for their design choices and approaches. They will provide simple elevation or three-dimensional drawings, with a detailed range of images.

For Pass standard, learners will carry out an investigation of existing elements and features on a given landscape or garden. Learners will carry out a basic analysis of existing features. They will produce an outline record of their findings, with limited understanding of the function of graphics and with some appropriate annotation and descriptive text of main key elements.

Learners will use their site analysis findings to identify potential areas on a site that will be suitable for some client requirements. Learners will compose a simple appraisal plan, showing realistic site opportunities and constraints. Learners will provide some explanation of the factors that influenced their decisions.

Learners will produce a limited range of function plans, showing some realistic consideration of client requirements. Function plans will demonstrate placing of voids and identify interrelationships from one space to another. Learners will explore a basic range of form plans, showing some awareness of design principles in their composition.

Learners will show a realistic awareness of the options available and select one form plan to produce a scaled sketch design, using basic graphics and minimal annotations to demonstrate links between client requirements and site suitability. Some materials or elements on the sketch design will be drawn to scale using a custom title block and border.

Learners will produce a design proposal with minimal alterations and design development from the sketch design. They will demonstrate some knowledge and understanding of design principles identified within their plan. Learners will produce an ink copy and explore colour rendering techniques. They will produce a broad range of annotations that identifies the materials, structures and plant types included in the design.

Learners will produce a report or presentation that will identify the design development process that includes the client's requirements and simple site analysis links. Learners will provide basic explanations for their design choices and approaches. There will be a broad range of images and documentation provided to communicate the mood and styling of the design ideas.

Links to other units

This unit links to:

- Unit 5: Operational and Environmental Activities in Land-based Enterprises
- Unit 7: Work Experience in the Land-based Sectors
- Unit 45: Computer-aided Design in Horticulture.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- practical application when reflecting on landscape and/or garden designs
- safe working practices and procedures when analysing sites.

Unit 43: Constructing Decorative Landscape Features

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners produce documentation for the construction of decorative landscape features and construct these features in line with agreed specifications.

Unit introduction

The ability to construct decorative landscape features is highly valued in the landscape and garden design industry. The construction process requires design, planning and management skills, which can also be applied to other horticultural roles. This unit is relevant to those who want to design or construct gardens with decorative landscape features.

In this unit, you will produce specifications and construction details, and carry out quantification, estimation and project planning. You will have the opportunity to construct decorative landscape features such as pergolas, gazebos, ponds, walls (dry stone, flint or brick), patios and outdoor kitchens, developing skills in design and construction and working safety.

Completion of this unit will help you to prepare for employment in a number of roles such as landscaper, quantity surveyor, landscapes manager (hard and soft). You could also progress to a higher-education course such as a degree in horticulture, landscape and garden design or construction.

Learning aims

In this unit you will:

A Develop specification and contract documentation for the construction of decorative landscape features

B Plan the construction and management of decorative landscape features

C Carry out the construction of decorative landscape features to meet planned specifications.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Develop specification and contract documentation for the construction of decorative landscape features	**A1** Existing site considerations **A2** Design interpretation and specifications development **A3** Construction detail drawings	Portfolio of evidence to include: • specifications and construction detail plans • contract documentation • a management schedule for the construction process.
B Plan the construction and management of decorative landscape features	**B1** Quantification and bills **B2** Contract documentation **B3** Planning a programme of works	
C Carry out the construction of decorative landscape features to meet planned specifications	**C1** Site preparation and safe site management **C2** Construction of features **C3** Review of works	Portfolio of evidence to include: • evidence of carrying out practical site preparation and construction activities • a review of the completed work, including necessary corrections, repairs or alterations.

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Content

Learning aim A: Develop specification and contract documentation for the construction of decorative landscape features

A1 Existing site considerations

Impact of site conditions and existing elements on the construction of landscaped features.

- Types of decorative landscape feature, including pergolas, gazebos, ponds, walls (dry stone, flint or brick), patios and outdoor kitchens.
- Interpretation of existing features from a survey plan and new construction works:
  - existing elements that need to be removed from site or repaired or protected during construction works, e.g. removal of existing hard surface, repair of fence, protecting valuable trees during works.
- Use of existing site conditions and proposed design proposal in developing a scope of works, e.g. clearance activities, level changes and site access/egress:
  - access and egress considerations that may assist or limit the installation of features
  - quantities and volumes of elements to remove, retain and protect on the site during construction works
  - current access for machinery and types of skill requirement, e.g. tree surgeon, utilities and excavator specialist
  - additional risk assessment based on weather conditions
  - site preparation, e.g. site clearance, general repair and waste-disposal requirements.

A2 Design interpretation and specifications development

Techniques and methods used to identify decorative landscape features of a garden design.

- Information from landscape design plans:
  - design plans and three-dimensional drawings, which include labels, annotations and a key, to communicate decorative landscape feature types and styling
  - hard landscape plans and their use in identifying proposed areas for decorative landscape features
  - scope of works or schedules to list decorative landscape features from a plan, including the name of the feature, preparation of site and general installation method descriptions.
- Specification methods for the provision of detailed construction information:
  - standard specification templates and construction plans when specifying information on how a decorative landscape feature is to be built, e.g. pergola, pond and paved surfaces using a laying pattern
  - specification types, including 'price to specification', written specifications and construction detail plans.

A3 Construction detail drawings

- Key information:
  - British Standards Institute and/or other national standards organisational/industry standards for construction methods
  - concrete and mortar mixes for foundations and brickwork (above and below ground)
  - timber spans in decking, pergola, gazebo and fencing construction
  - retaining structures (soil and/or water)
  - design styling, finishes for surfaces, jointing, patterns and colours
  - decorative features that have multiple forms, e.g. pond construction as both solid feature structure and flexible liners methods, including fibreglass, tile finish and flexible liner types.
- Benefits of construction detail drawings, e.g. specific paving patterns, timber jointing detailing and concrete footing depths with mix ratio and reinforcing.
- Technical drafting methods in the production of construction detail plans, including design styling of the feature, dimensions, specifications for fixtures, fittings and layout plans that use suitable scales, materials used and any manufacturers' technical information.

Learning aim B: Plan the construction and management of decorative landscape features

B1 Quantification and bills

Techniques and processes for producing estimates and quotations.

- Methods of quantification to calculate landscape features of plan, e.g. standard method of measurement (SMM), measurement tools and computer-aided design (CAD).
- Methods used to calculate:
  - area, volume, mixes (ratios of cement and aggregate types)
  - materials, including cuts, waste, accidental mistakes, weather issues such as frost and heat.
- Techniques in costing labour, including daylight hours, holiday allowance and potential absence or adverse weather conditions.
- Pricing up and ordering of materials.
- Methods of pricing preliminary requirements, e.g. security, welfare facilities and working hours and deadlines.
- Methods of presenting a bill of quantity, including rates and lump sum for cost management:
  - use of various pricing methods to assist client and designer management of construction of landscape features, e.g. priced scope of works, bills of quantity and total cost
  - industry standard profit margins and overheads, including final valuation.

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B2 Contract documentation

- Professional practice and management system for employing contractors:
  - options of contract between client and contractor prior to construction works commencing, e.g. Joint Council for Landscape Industries (JCLI), British Association of Landscape Industries (BALI) and Association of Professional Landscapers (APL) in association with the Horticultural Trades Association (HTA), or other equivalent/similar organisations
  - client, designer and contractor roles
  - development of preliminaries and identification of responsibilities, e.g. provisions of welfare facilities, requirements to provide utility services (use of existing or own provision) and security.
- The tender process, including invitation to tender letter with documentation (plans, quantities and specifications), letter to successful contractor and appointment of contractor.

B3 Planning a programme of works

- Methods of planning, including schedule of works for the construction of a decorative landscape feature:
  - use of Gantt charts, spreadsheets and project management software to plan the construction of a decorative landscape feature
  - the benefits of prioritising the order of a scope of works, e.g. access to site, storage space, time and cost efficiency.
- Use of prioritisation and management in ordering of materials to assist the efficient running of a schedule of works, including delivery dates, minimising waste of materials and the access to and handling of materials safely around the site.
- Benefits of method statement production, e.g. informs staff of tasks, provides access to health and safety information.
- Planning staff schedules to meet deadlines.
- Contingency planning, including staff absence, adverse weather, unavailability of machinery or equipment.

Learning aim C: Carry out the construction of decorative landscape features to meet planned specifications

C1 Site preparation and safe site management

Carrying out site preparation to ensure a safe working environment.

- Following scheduled operations and adapting when needed, including identifying all required preparations, e.g. removal of existing vegetation or surfaces, excavations and site protection where required.
- Managing required materials, including placing order in a timely manner, safe delivery and protection from elements while being stored.
- Setting out of proposed features, including outline of a feature with levels, removal of materials that need to be replaced, ensuring safe access and movement within and around the working area.
- Managing site health and safety and following relevant legal requirements, e.g. provision of personal protective equipment (PPE), signage and access to welfare facilities.
- Construction (Design and Management) Regulations 2015 (CDM) or equivalent/similar national regulations and their implication for the construction of a landscape feature.
- Risk assessment and method statements.

C2 Construction of features

Managing a sustainable and safe range of construction activities.

- Safe application of methods to construct a given landscape feature.
- Use of techniques to meet given design specifications.
- Management of time, progress and safe working practice, e.g. time sheets, site meetings and daily site-specific risk assessing.
- Safe use of equipment and tools, e.g. suitability for the task, working in the parameters of the risk assessment and storage and maintenance.

C3 Review of works

Review of works carried out against the given specification.

- Identification of and rectification of elements that do not meet the specification (snagging).
- Methods to record and manage snagging, e.g. visual checklist, measurement accuracy checks and instructions for amendments to be carried out.
- Leaving the site in good condition, e.g. finishing and presentation, waste removal, repairing damaged surfaces or access points, removing anything that makes the site unsafe.
- Outcomes of the review and how they can inform future work and improvements to methods used, e.g. type of material ordered, timescale and milestones, level of resource requirement.

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Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Develop specification and contract documentation for the construction of decorative landscape features</td><td rowspan="2">A.D1 Produce comprehensive specification and contract documentation for the construction of decorative landscape features.</td></tr>
<tr><td>A.P1 Produce basic specification documentation for the construction of decorative landscape features.
A.P2 Produce outline contract documentation for the construction of decorative landscape features.</td><td>A.M1 Produce detailed specification and contract documentation for the construction of decorative landscape features.</td></tr>
<tr><td colspan="2">Learning aim B: Plan the construction and management of decorative landscape features</td><td rowspan="2">B.D2 Produce comprehensive plans for the construction and management of decorative landscape features.</td></tr>
<tr><td>B.P3 Plan basic decorative feature construction.
B.P4 Produce simple management plans for the construction of decorative landscape features.</td><td>B.M2 Plan complex decorative feature construction.
B.M3 Produce detailed management plans for the construction of decorative landscape features.</td></tr>
<tr><td colspan="2">Learning aim C: Carry out the construction of decorative landscape features to meet planned specifications</td><td rowspan="2">C.D3 Demonstrate complex and efficient construction activities for a decorative landscape feature, justifying the methods used.</td></tr>
<tr><td>C.P5 Demonstrate basic construction activities for a decorative landscape feature.
C.P6 Explain methods used in the construction of a decorative landscape feature.</td><td>C.M4 Demonstrate complex construction activities for a decorative landscape feature.
C.M5 Analyse methods used in the construction of a decorative landscape feature.</td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, B.M3, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M4, C.M5, C.D3)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- land-based library and internet resources
- drafting boards
- drafting drawing equipment
- project site
- surveying equipment: surveying tapes, fixing arrows, stakes, string lines and marker spray
- level surveying equipment, e.g. optical level and laser level
- IT facilities with word-processing and spreadsheet software
- construction equipment.

Essential information for assessment decisions

Learning aims A and B

Learners will individually produce specification and contract documentation as well as individually produced construction detail and management plans.

For Distinction standard, learners will compile a highly detailed, effective specification for two decorative landscape features and the associated site preparation works, demonstrating depth and breadth of knowledge and understanding. They will meticulously carry out and record quantifications for materials, and source resources for standard available sizes or weights to minimise waste. This could include designing the feature using commercially available material sizes such as timber to prevent or minimise waste. Learners will price all materials, fixtures and fittings accurately for both decorative landscape features.

Learners will produce detailed, accurate contract documentation with all letters required to engage contractors, including clear detail of the potential scope of work. Learners will develop relevant customised documents that invite to tender and award the winning tender. They will complete, in full detail, a contract for the construction of the decorative landscape feature, which reflects best practice in the workplace.

Learners will produce comprehensive and robust scaled construction detail plans for two decorative landscape features, with accurate specification information that includes British Standards or equivalent/similar industry standards. All dimensions will be illustrated clearly for all plan views and cross-section views used. The title block information will be completed in full.

Learners will produce an accurate and complete plan to manage the safe and timely construction process for each decorative landscape feature. The management plan will include a detailed and comprehensive time schedule that identifies all tasks from site preparation to the quality review of finished works. Learners will have accurately identified the provisions of extra time for inclement weather conditions, material order delays and scheduled breaks.

Learners will complete thorough, accurate risk assessments for all identified construction and clearance activities. The assessments will identify all health and safety issues, required PPE, site security and site-specific assessment if conditions on site were to change. Learners will support their risk assessments with a comprehensive method statement that identifies the scope of work to be carried out with associated risks that link clearly to the risk assessment.

For Merit standard, learners will produce specifications, with relevant detail, for two decorative landscape features and most of the associated site preparation works, demonstrating appropriate breadth of knowledge and understanding. They will have effectively carried out and recorded quantifications for materials and sourced some of the resources for standard available sizes/weights to minimise waste. This could include selecting timber lengths to meet given requirements with minimal waste. Learners will give a generally appropriate range of prices for their materials, fixtures and fittings.

Learners will produce generally clear and relevant contract documentation with all letters required to engage contractors and provide a basic potential scope of work. They will develop some customised documentation and use standard documents that invite to tender and award the winning tender. Learners will complete key parts of an industry standard contract for the construction of the decorative landscape feature.

Learners will produce detailed scaled construction plans for two decorative landscape features and include key specification information with relevant British Standards or equivalent/similar industry standards. All key dimensions will be illustrated clearly for most plan and cross-section views used. Key title block information will be completed for each drawing.

Learners will produce a complete plan to manage the safe and timely construction process for the decorative landscape feature, with mostly appropriate and relevant detail. The management plan will include a realistic time schedule that identifies the main tasks from site preparation to the quality review of finished works. They will have identified the need for extra time for one or two of the following: inclement weather conditions, material order delays and scheduled breaks.

Learners will complete detailed risk assessments that cover most of the identified construction and clearance activities. The assessments will include relevant health and safety issues, PPE, site security and will identify the requirement for site-specific assessments if conditions on site were to change. Learners will support their risk assessments with a method statement that identifies key aspects of the scope of works to be carried out with associated risks that link appropriately to the risk assessment.

For Pass standard, learners will produce outline specifications for two decorative landscape features and identify basic associated site preparation works, demonstrating realistic but undeveloped knowledge and understanding. They will carry out and record basic quantifications for materials with some limited research into how they can minimise waste. This could include, for example, identifying the range of sizes commercially available for items such as timber, but learners may not apply this in their design development or ordering. Learners will give prices for the materials, fixtures and fittings for two decorative landscape features but may not cover all the necessary aspects, for example quantity of screws required or the separation of mortar materials.

Learners will produce basic contract documentation with all the letters required to engage contractors. They will use simple standard documents that invite to tender and award the winning tender, and will make basic adjustments to an industry standard contract for the construction of the decorative landscape feature, but this may not be completed in full.

Learners will produce basic scaled construction plans for two decorative landscape features, including specification information using industry standards or template specification options. Some key dimensions will be included on plans and some of the title block information will be completed for each drawing, for example learners will give the heights of a feature but may neglect width, thickness and depth.

Learners will produce an appropriate and mostly relevant plan to manage the construction process for the decorative landscape feature. The management plan will include an outline time schedule that identifies relevant tasks for some of the site preparation and build activities but may not include a quality review of finished works. They will provide simple alternatives relating to extra time requirements, for example turning up late, illness or time lost for forgetting tools/materials, but may not consider the need for extra time for the following: inclement weather conditions, material order delays and scheduled breaks.

Learners will produce simple but realistic risk assessments for the construction and clearance activities, identifying health and safety issues, PPE and site security. Learners will provide a basic method statement, showing a realistic awareness of the work activities to be carried out, with links to relevant associated risks.

Learning aim C

Learners will individually construct one of the designed decorative landscape features that they have specified and planned.

For Distinction standard, learners will demonstrate the practical skills required to construct a decorative landscape feature to a standard that reflects best practice in the workplace.

They will carry out detailed, accurate measurements for setting out the decorative landscape feature, paying detailed attention to their construction detail plan. Learners will identify accurate time allowances for each construction stage, routinely managing the safe selection and arrangement of tools, equipment and materials at the start and end of each working period. They will carry out meticulous clearance activities safely and efficiently, including the separation, removal and disposal of all waste items and visible debris, according to the specification and complying with local waste-management regulations.

Within the limits of their responsibility, learners will evidence insightful ways to minimise risk and demonstrate proficient safe working practices throughout, including the need to ensure the safety of those working around them. They will carry out practical construction activities with a high degree of accuracy, including all elements from the construction detail plan specification. Learners will negotiate and make adjustments to their plans if issues arise, demonstrating breadth and depth of understanding of the construction process. They will select and utilise the correct materials, tools and equipment to produce minimal waste and to maximise the efficient use of time and resources. They will monitor their progress against their time schedule regularly and effectively. If a schedule is not being met, learners will adjust the time allowance and identify efficiencies, for example start and finish times, location of material storage and design adjustments.

On completion of the decorative landscape feature, learners will carry out a detailed checklist and assessment that will comprehensively review the work carried out, the finished quality, suitability for purpose and the safety aspects. They will accurately identify any improvements, alterations or repairs. They will carry out all finishing works with a meticulous eye for detail and leave the site clear of all waste, dirt, tools and leftover material, ready for signing off.

Learners will fully review the methods they used and thoroughly explore where they were successful. They will demonstrate both depth and breadth of learning in their reasoning as to where methods could be improved or carried out differently.

For Merit standard, learners will demonstrate the practical skills required to construct a decorative landscape feature safely and efficiently.

They will produce detailed measurements for setting out the decorative landscape feature, referring to their plan to confirm what needs to be carried out. Learners will show an understanding of the time allowed for the construction stages, and regularly select and arrange tools, equipment and materials at the start and end of each working period. They will carry out clearance activities safely and competently, including the separation of some material, and the removal and disposal of the different waste items and some visible debris according to the specification and complying with local waste-management regulations.

Within the limits of their responsibility, learners will assess risks and hazards and use the required tools and equipment, demonstrating a clear understanding of the need to take into account the safety of those working around them. They will carry out the practical construction activities with competence, demonstrating a sound understanding of the practices involved. Learners will focus on following the construction detail plans and specification. They will apply basic negotiations and adjustments if issues arise, for example brickwork not being straight or perpendicular. Learners will select and utilise most of the relevant tools, equipment and materials, producing minimal waste and making mostly efficient use of resources. Learners will monitor their progress against their time schedule for the key stages of the process and make adjustments to safely return to the schedule through labour efficiency or adjustments to the design.

On completion of the decorative landscape feature, learners will carry out a checklist and assessment that will review the work carried out, the finished quality, suitability for purpose, safety and identify any improvements or repairs needed. They will carry out all finishing works and leave the site clear of all waste, dirt, tools and leftover material, ready for signing off.

Learners will reflect on the methods they used and will make clear, generally relevant connections to their impact on the construction of the decorative landscape feature.

For Pass standard, learners will demonstrate the practical skills required to construct a decorative landscape feature safely and competently.

Learners will carry out basic setting-out activities for the decorative landscape feature, demonstrating an awareness of the need to refer to their plan as they carry out the work. Learners will be aware that there is an amount of time allowed for each construction stage but not always work to these time allowances. Learners will use the appropriate tools, equipment and some materials at the start and end of each working period. They will carry out some clearance activities safely and remove and dispose of waste according to local waste-management regulations.

Learners will work safely, with a realistic but limited awareness of the risks and potential issues. They will carry out the practical construction activities safely with a basic focus on following the construction detail plans and specification. Learners will select and utilise appropriate materials to produce minimal waste. To ensure that they meet their deadlines, they will require some direction to monitor their time schedule.

On completion of the decorative landscape feature, learners will carry out a simple checklist and basic assessment review of the work carried out, the finished quality and safety aspects, and they will identify any repairs needed. They will carry out some of the finishing works and leave the site mostly clear of all waste, dirt, tools and leftover material, ready for signing off.

Learners will give some relevant reasons for their selected methods, demonstrating realistic but undeveloped understanding of the impact these methods have on the successful construction of the decorative landscape feature.

Links to other units

This unit links to:

- Unit 7: Work Experience in the Land-based Sector
- Unit 42: Landscape and Garden Design
- Unit 44: Linear and Level Surveying.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- organisational and team-working skills
- practical application when reflecting on decorative feature construction
- safe working practices and procedures when decorating landscapes.

Unit 44: Linear and Level Surveying

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop the skills needed to carry out the initial extraction of site data to present as a graphic designed plan and to set out a site from a plan.

Unit introduction

Surveying is an essential skill for horticulturalists who are involved the development of sites such as gardens, parks, sports grounds and nurseries. Skills in and understanding of surveying are relevant for roles that involve site maintenance and development programmes and garden design plans. These skills and understanding enable the production of accurate site plans that take into account all the necessary considerations.

In this unit, you will develop the skills needed to carry out accurate linear and level surveys using equipment that is commonly available in the industry. You will look at the process of recording site data and how it is presented as drawn survey plans. You will consider issues of setting out a site from a plan, including two-dimensional areas and three-dimensional setting out for gradients.

This unit will help you to progress to employment in a number of roles, for example head groundsperson, landscapes manager (hard and soft). You could also progress to a higher-education course in an area such as landscape and garden design, landscape architecture.

Learning aims

In this unit you will:

A Investigate methods used in linear and level surveying of sites
B Undertake linear and level surveying of sites to produce accurate data and representations
C Carry out setting out on the ground from plans.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate methods used in linear and level surveying of sites	**A1** Methods, equipment and recording **A2** Potential issues and constraints	Report analysing the different methods and approaches used to carry out linear and level surveying. Portfolio of practical evidence, including evidence of: • carrying out linear and level surveys safely • producing documentation to record the survey outcomes.
B Undertake linear and level surveying of sites to produce accurate data and representations	**B1** Working safely. **B2** Managing a survey and associated equipment **B3** Presenting outcomes of measures and surveys	
C Carry out setting out on the ground from plans	**C1** Interpreting and developing plans **C2** Setting out	Portfolio of practical evidence, including evidence of: • producing a setting-out plan • carrying out setting-out activities safely, both in shape and level.

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Content

Learning aim A: Investigate methods used in linear and level surveying of sites

A1 Methods, equipment and recording

Techniques and processes required in the collection and collation of site data for linear and levelling surveying.

- Linear surveying processes:
  - equipment required in carrying out a linear survey, including surveying tapes, ranging poles, measuring wheel and arrows (fixing pins)
  - interpretation of linear survey information to develop a site inventory, e.g. boundaries, existing features and trees
  - methods for a nominated site to be surveyed, e.g. grid reference/bearing with OS (Ordnance Survey) maps and GPS coordinates (longitude and latitude) with digital devices.
- Methods of recording linear survey site data:
  - linear survey booking sheets, recording of sites, aspect and site outline sketch
  - mapping of site inventory information using single and multiple baseline methods
  - use of the offset method in the recording of baseline data and object data, including identification of the suitability and reliability (sources of error) of their use
  - use of triangulation methods in the recording of baseline data and object data, including possible issues and sources of error when using this technique.
- Techniques to record curvilinear lines and trees, including their canopy and girth, utility services and external building details, e.g. location of windows, doors, drainpipes and inspection chambers.
- Current digital methods used to conduct linear surveying, including total stations and GPS.
- Level surveying processes:
  - equipment required in level surveying, equipment set-up methods, techniques in using and reading measurements
  - the application of level surveys, including OS benchmarks, contour plans, falls and slopes
  - identification of a topographical rise and fall
  - provision of a suitable fixed-site datum and considerations for its selection, e.g. a fixed and permanent point on site, door threshold, known OS benchmark
  - identification of different level survey types, e.g. spot heights, grid survey and cross-section survey
  - identification of backsights, intermediate sights and foresights.
- Methods of recording level survey site data using a rise and fall notebook.
- Methods of interpreting survey measurements, including identification/calculation of a rise or fall, reduced levels relating to an actual OS benchmark or a suitable imposed site datum.
- Impact of supporting information when recording level survey measurements, including descriptions, grid references and linear measurements (points along a tape measure).
- Techniques for surveying significant level changes.

- Methods of moving equipment and recording on the notebook, including backsights, intermediate sights and foresights.
- Methods of checking accuracy on a rise and fall notebook, including manual calculation checks and digital rise and fall spreadsheet formula templates.

A2 Potential issues and constraints

Implications of site conditions and recording of measurements that affect survey accuracy.

- Limitation of offsets that restrict their effective use, e.g. where a right angle cannot be achieved (obstacles), exceeding 8 m and topography.
- Baseline security and the implications of it being moved during a survey.
- Identification of site conditions that will affect effective surveys both linear and level, e.g. site safety issues during inclement weather, linear surveying on slopes, multiple visual and physical obstacles.
- Need for accurate reading of survey tapes and level survey measurements.
- Methods for writing and recording of survey measurements that include offsets, triangulations and levels measurements.
- Identification of a rise and of a fall, calculations and accuracy checks.
- Common issues:
  - trips and falls
  - hidden hazards
  - debris
  - above height hazards
  - unprotected services/utilities
  - broken and faulty equipment, e.g. stretched tapes, optical levels out of service.

Learning aim B: Undertake linear and level surveying of sites to produce accurate data and representations

B1 Working safely

- Health and safety procedures when carrying out activities:
  - correct and safe selection, use, transport and carrying of equipment
  - potential hazards when using equipment for the user and others
  - use of personal protective equipment
  - identification of hazards when carrying out surveying, including risk assessment of: adverse weather conditions, working alone or public access areas, hidden site hazards
  - safe working procedures to ensure protection of self and others.

B2 Managing a survey and associated equipment

- Use of available pre-survey information or documentation, e.g. services plan, Geographical Information Systems (GIS) for climate, soil, planning restrictions or developments and land-ownership documentation.
- Carrying out linear surveying:
  - safe application of the linear survey and accurate recording of the data
  - methods to deal with complex survey areas and shapes using single and multiple baselines, including curvilinear borders or ponds, working around obstacles and irregular-shaped sites

  - offsets to achieve accuracy and apply recording methods of data
  - use of triangulations to achieve accuracy and apply recording methods of data, including perimeters, garden features and key vegetation (trees and shrubs).
- Carrying out level surveying:
  - safe application of a level survey and accurate recording of the data, including the identification of a datum point, cross-section survey, spot heights and grid survey
  - use of methods for the relocation and moving of level surveying equipment within a given survey and the application of the techniques required for recording the data
  - use of calculation techniques to interpret the backsights, intermediate sights and foresights in developing rise or fall data.

B3 Presenting outcomes of measures and surveys

- Application of site survey and inventory scaled plan development:
  - selection of a suitable scale to suit designated paper size
  - producing sufficient site detail using drafting equipment, including drawing board with parallel motion, scale ruler, protractors and compass
  - using setting-out techniques for a survey plan with a border, title block and completed information panel with aspect, drawing name, scale and key
  - setting out of linear survey information, applying booking sheet data with offset and loci for triangulation
  - use of plotting techniques, to scale, to produce an overall plan view of all site inventory information.
- Application of a level survey booking sheet to produce reduced levels that relate to OS benchmark or selected datum level point with all accuracy checks.
- Plotting of reduced levels onto a linear survey plan, e.g. spot heights or grid heights.
- Application of a cross-section survey plan, identifying suitable scale to communicate sufficient detail.

Learning aim C: Carry out setting out on the ground from plans

C1 Interpreting and developing plans

- Interpretation of plans to identify individual design elements, their height and linear measurements information to aid with setting out on a given site, e.g. dimensions, falls and shapes.
- Methods for developing a setting-out plan from a given design plan, including identification of accurate measurements and points of reference, e.g. building offset and centre points, this should also identify the importance for the direction of fall and the appropriateness of using a 1:100 and 1:80 fall.

C2 Setting out

- Application of a 3/4/5 triangle to secure a 90° angle for rectangles and square shapes, including running lines for extended distances and larger features.
- Selection and safe use of equipment and resources suitable to meet accuracy.
- Application of methods to assess accuracy.
- Application of techniques that accurately aid the setting out of various elements on a site, including a curvilinear border, hexagon, circle and ellipse.
- Use of techniques to apply proposed levels on a site that provide a fall for a patio or land drain at 1:100 and 1:80.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate methods used in linear and level surveying of sites		**A.D1** Evaluate methods and approaches used in linear and level surveying of sites.
A.P1 Explain methods and approaches used in linear surveying of sites. **A.P2** Explain methods and approaches used in level surveying of sites.	**A.M1** Assess methods and approaches used in linear and level surveying of sites.	
Learning aim B: Undertake linear and level surveying of sites to produce accurate data and representations		**B.D2** Carry out comprehensive linear and level surveys of given sites, producing survey documentation with a high degree of accuracy.
B.P3 Carry out a basic linear survey of a given site, producing outline survey documentation. **B.P4** Carry out a basic level survey of a given site, producing outline survey documentation.	**B.M2** Carry out a complex linear survey of a given site, producing detailed survey documentation. **B.M3** Carry out a complex level survey of a given site, producing detailed survey documentation.	
Learning aim C: Carry out setting out on the ground from plans		**C.D3** Demonstrate accurate and efficient setting out of a site, following own comprehensive setting-out plan.
C.P5 Demonstrate basic setting out for a site. **C.P6** Produce a simple setting-out plan for a given site.	**C.M4** Demonstrate complex setting out for a site. **C.M5** Produce a detailed setting-out plan for a given site.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aims: A and B (A.P1, A.P2, B.P3, B.P4, A.M1, B.M2, B.M3, A.D1, B.D2)

Learning aim: C (C.P5, C.P6, C.M4, C.M5, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- OS local maps
- drafting boards
- drafting drawing equipment
- survey site with existing details to record
- survey site with undulations and significant level changes
- surveying equipment – surveying tapes, ranging poles, measuring wheel and arrows (fixing pins), stakes, string lines and marker spray
- level surveying equipment, e.g. optical level, laser level, GPS or total station.

Essential information for assessment decisions

Learning aims A and B

Learners will individually consider the different methods and approaches used to carry out linear and level surveying. They will individually carry out linear and level surveys and produce survey outcome documents.

For Distinction standard, learners will provide a comprehensive and detailed account of a range of linear and level surveying techniques, showing breadth and depth of knowledge. Learners will make well-reasoned and valid judgements on the potential approaches and methods that can be used, covering both advantages and disadvantages. Learners will show in-depth understanding of the techniques, equipment and methods of recording used, supported by well-considered examples such as booking sheets, that show clearly how data should be presented.

For linear surveys this will include detailed, accurate understanding of offsets, triangulations, single and multiple baseline use and location of survey points and, for level surveys, datum types and data processes to produce reduced levels.

Learners will carry out a detailed and accurate linear survey using offsets and triangulation where suitable. They will record the data meticulously, using a clear and concise process of data presentation, and include key perimeters, structures and key vegetation. In their data presentation, they will include key measurement data, sketch overview, aspect, total distance baseline measurement and label descriptions for most reference points. Learners will transfer their measurement data and description meticulously, using a suitable scale on a plan with a standard layout or border, title block and information panel. The plan will be completed to a standard that reflects best workplace practice.

Learners will carry out a detailed and accurate level survey. They will identify a suitable point for a datum, a clear point of view that will minimise the relocation of the equipment and carry out data collection as spot heights or a grid survey, applying detailed remarks for each sight. Learners will produce a comprehensive level-booking sheet(s) with key recorded backsights, intermediate sights and foresights, to provide accurate rise and fall calculations and reduced levels, with key accuracy checks completed. Learners will produce professional survey recording documentation (scaled levels overlay or combined with the linear survey inventory plan as spot heights or grid survey with all relevant reduced levels and datum point) and a cross-section plan, using a suitable scale that clearly demonstrates the rise and fall of the given site.

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For Merit standard, learners will provide a detailed account of a range of linear and level surveying techniques, demonstrating clear knowledge and understanding. Learners will make mostly relevant judgements on the potential approaches and methods that can be used and in what situations they would be most effective. Learners will show clear understanding of the techniques, equipment and methods of recording, supported by mostly relevant examples, such as basic booking sheets, that identify how data can be presented.

For linear surveys, this will include clear understanding of offsets, triangulation, single and multiple baseline use, and how to locate survey points. For level surveys, this will include how to set the equipment up, datum types and descriptions of how to calculate rise of all levels and produce reduced levels.

Learners will carry out a detailed linear survey, using offsets and triangulation where suitable, identifying techniques to meet accuracy requirements. They will record the data correctly, using a clear process of data presentation that will include key perimeters, most structures and key vegetation. The presentation will identify a broad range of measurement data, sketch overview, aspect, total distance baseline measurement and label descriptions for most elements. Learners will transfer their measurement data and main descriptions using a suitable scale to a plan, with a standard layout or border, title block and information panel. Learners will produce a detailed plan.

Learners will carry out a detailed level survey. They will identify a suitable point for a datum and a clear point of view that will minimise the relocation of the equipment, they will carry out data collection as spot heights or a grid survey, applying remarks for most sights. A complete level-booking sheet(s) will be produced, with key recorded backsights, intermediate sights and foresights, to provide accurate rise and fall calculations, and reduced levels, with most accuracy checks completed. Learners will produce complete survey recording documentation (scaled levels overlay or combined with the linear survey inventory plan as spot heights or grid survey with key reduced levels and datum point) and a cross-section plan, using a suitable scale that demonstrates the reduced levels of the given site.

For Pass standard, learners will provide an account of linear and level surveying techniques, showing limited knowledge and understanding. Learners will explain the potential approaches and methods used and when they are used. Learners will show a realistic awareness of the techniques, equipment and methods of recording used, supported by some relevant examples, such as a booking sheet used to record data.

For linear surveying, this will include understanding of offsets, triangulation and single and multiple baseline use. For level surveys, this will include how to set up equipment, how to apply methods to calculate rise and fall between data, and produce reduced levels.

Learners will carry out a simple linear survey, using offsets and triangulation where suitable, and identify some techniques to meet accuracy requirements. They will record most of the data with basic techniques that will include key perimeters, some structures and vegetation. The data presentation will identify a key perimeter measurement data, aspect, and total distance baseline measurement with limited label descriptions for selected elements. Learners will transfer basic measurement data, using scale, to a plan with a standard layout or border, title block and information panel. They will produce a basic plan.

Learners will carry out a simple level survey. They will identify a datum location, showing limited consideration for the survey equipment that may require more relocation, and carry out data collection as spot heights or a grid survey, applying some remarks for the data sights. Learners will produce a simple level-booking sheet with some recorded backsights, intermediate sights and foresights to provide basic rise and fall calculations using a spreadsheet formula, with basic accuracy checks completed. Learners will produce basic survey recording documentation (scaled levels overlay or combined levels with the linear survey inventory plan as spot heights or grid survey with most of the recorded reduced levels) and a cross-section plan that identifies the reduced levels of the given site.

Learning aim C

Learners will individually produce a setting-out plan and perform setting-out activities safely, both in shape and level.

For Distinction standard, learners will interpret a given design plan comprehensively, accurately identifying all key design elements and all information sources, including heights, centre points and the setting-out methods required. Based on their interpretation, learners will produce a comprehensive setting-out plan or overlay that correctly identifies all measurements, e.g. setting out angles through loci triangulation, centre points and offsets measurements.

Learners will demonstrate the practical skills required to carry out all setting-out activities for all shapes that met the given tolerance, to a standard that reflects best practice in the workplace. They will mark out all elements using supplied mediums in a sustainable manner.

Learners will provide a comprehensive risk assessment that includes key risks linked to setting out, with potential hazards of equipment used and a comprehensive review of control measures to be put in place. Learners will demonstrate proficient safe working practices throughout.

Learners will set out a given plan that meets given tolerance; they will demonstrate meticulous attention to accuracy in the majority of measurements that utilise accurate methods and techniques, e.g. 3/4/5 triangle, running measurements, line marking.

Learners will demonstrate depth of knowledge and understanding in the setting out or excavation of levels, using a range of levelling equipment and techniques safely and accurately. Learners will carry out levels meticulously, using less than 50 per cent of the given tolerance in the application of a 1:100 and 1:80 fall within identified set out shapes, e.g. patio, path.

Learners will review their approaches in terms of their effectiveness in setting out the ground. They will explore thoroughly where they were successful and where approaches could have been improved or carried out differently.

For Merit standard, learners will interpret a broad range of key design elements in a given plan accurately and create a setting-out plan or overlay that identifies required measurements for setting out, e.g. perimeter, centre points, offsets measurements.

Learners will demonstrate safe and efficient working practices when undertaking setting-out activities for all shapes that met the given tolerance. They will mark out most of the elements using supplied mediums in a sustainable manner.

Learners will provide a risk assessment that includes a broad range of potential risks linked to setting out, with the potential hazards of equipment used and effective control measures to be put in place. Learners will demonstrate safe and effective work practices throughout.

Learners will set out a given plan that meets given tolerance and demonstrates an understanding of the need to meet accuracy in all measurements. They will utilise relevant methods and techniques to carry out the setting-out tasks, e.g. 3/4/5 triangle, running measurements and line marking.

Learners will demonstrate relevant knowledge and understanding in the setting out or excavation of levels, using a range of levelling equipment and techniques safely and competently. Learners will carry out levels using more than 50 per cent of the given tolerance in the application of a 1:100 and 1:80 fall within the identified set out shapes, e.g. patio, path.

Learners will reflect on the approaches they used and their effectiveness, with mainly relevant recommendations for improvement.

For Pass standard, learners will interpret simple design elements in a given plan and place measurements identified on to the setting-out plan or overlay. They will identify setting-out information and the measurements to be applied in the setting-out activity.

Learners will demonstrate the practical skills needed to carry out setting-out activities for some of the shapes that met the given tolerance safely and competently. They will be able to identify some sources of error and faults. They will mark out main features that identify 3/4/5 triangle, triangulation and two shapes using supplied mediums in a sustainable manner.

Learners will provide a realistic risk assessment that identifies a basic range of risks linked to setting out, with the potential hazards of equipment used and simple control measures to be put in place. Learners will demonstrate safe working practices throughout.

Learners will set out a given plan and identify errors or potential faults if tolerance has not been met. They will utilise required methods and techniques to carry out the setting-out tasks, e.g. 3/4/5 triangle, running measurements, line marking.

Learners will demonstrate basic knowledge and understanding in the setting out or excavation of levels, using basic levelling equipment safely. Learners will fully utilise the given tolerance in the application of a 1:100 and 1:80 fall within the identified set out shapes, e.g. patio, path.

Learners will demonstrate realistic but limited understanding of how the approaches used affected the setting-out activities carried out.

Links to other units

This unit links to:

- Unit 7: Work-based Experience in the Land-based Sectors
- Unit 42: Landscape and Garden Design
- Unit 43: Constructing Decorative Landscape Features.

Employer involvement

This unit would benefit from employer involvement in the form of:

- masterclasses
- technical workshops with staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research and analysis skills through investigation of surveying methods
- evaluative and developmental skills
- practical application when setting out sites
- safe working practices and procedures when surveying complex sites.

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Unit 45: Computer-aided Design in Horticulture

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners develop two-dimensional (2D) detailed drawings and three-dimensional (3D) models using a computer-aided design (CAD) system.

Unit introduction

Computer-aided design (CAD) spans most areas of horticulture and landscape gardening as well as aspects of other disciplines such as construction and media. Horticulture and landscape gardening is a multi-disciplinary vocational subject that uses CAD as part of other processes to develop and aesthetically improve existing gardens. As a horticulturalist, it is important to be able to interpret and produce drawings that help individuals and organisations to communicate ideas, designs for plans and products, and improve landscapes.

In this unit, you will use CAD software and hardware to produce 2D and 3D drawings. You will acquire the skills needed to produce models of horticultural products and landscape gardens and to edit and modify them. You will explore panning, symbols and layers. You will produce a portfolio of drawings, such as orthographic, 3D shaded or solid model and detail view drawings, to an international standard.

This unit will help you to progress to employment as a draftsperson or to other technician-level roles in horticulture. The unit will also give you the skills, knowledge and confidence to progress to a horticultural-based apprenticeship or to a higher-education course in horticulture.

Learning aims

In this unit you will:

A Produce a 2D computer-aided garden design plan

B Produce a 3D element based on a computer-aided garden design plan

C Produce 2D construction detail plans and a planting schedule based on 3D features.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Produce a 2D computer-aided garden design plan	**A1** Using 2D drawing commands **A2** Developing 2D horticultural drawings **A3** Output of 2D drawings	A practical drawing activity to produce computer-aided 2D drawings of a garden design, using layers.
B Produce a 3D element based on a computer-aided garden design plan	**B1** 3D modelling and modelling commands **B2** Developing a 3D component **B3** Output of drawings from a model	A 3D model of three 3D elements of a computer-aided garden design plan and three drawings of the 3D model with multiple viewports. Two 2D construction detail plans containing multiple 2D views and technical information, and a planting plan and schedule for a 15 m² area.
C Produce 2D construction detail plans and a planting schedule based on 3D features	**C1** Construction detailing **C2** Planting plan and plant schedule **C3** Output of product drawings	

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Content

Learning aim A: Produce a 2D computer-aided garden design plan

A1 Using 2D drawing commands

- Configuration of a 2D CAD system, including format units, snap and automatic snaps, grid, precision, angular, drawing limits, layers, user coordinate system, world coordinate system and file systems.
- Use of drawing commands, including line, arc, circle, polyline and open circle.
- Use of polar array for relevant features, e.g. step stones, fence posts, panels, pergolas.
- Use of display commands, including pan and zoom.
- Use of modify commands, including erase, trim, mirror, move, array, copy, undo and stretch.

A2 Developing 2D horticultural drawings

- Drawing commands, including line types, centre line, dashed, text, offset, hatching and editing of hatching.
- Use of layers and object information controls/classes, including manipulation, creation, switching on/off, frozen and locked.
- Use of blocks/symbols, including creation of blocks/symbols, symbols library and insertion of blocks.
- Use of modify commands, including mirror, pan, scale, chamfer and fillet.
- Use of dimensioning, including dimension styles, dimensions, and editing of dimensions.

A3 Output of 2D drawings

Drawings to be produced to relevant international standards.

- Set up of output parameters, including paper size, units, plot area, scale, orientation, paper space, model space, model and layout drawing and template.
- Creation of the design plan, including orthogonal views and appropriate scale.
- Creation of a final layout plan, including use of:
  - CAD file name, drawing title, date, drawn by details, outer frame, callouts, title block with scale
  - annotations to identify material types and heights of elements if necessary
  - printing in scale and use of colour, textures and line style.

Learning aim B: Produce a 3D element based on a computer-aided garden design plan

B1 3D modelling and modelling commands

- Configuring the parametric modeller, including origin, units, snap and grid, correct format, project files, selection of file types and planes, e.g. XY, XZ and YZ.
- Sketching commands, including line and polyline, arc, centre line, construction line, circle, fillet and dimension.
- Display commands, including pan, zoom and orbit.
- Editing commands, including erase, extend, trim and rotate.
- Construction commands, including:
  - 3D primitives, e.g. cube, cylinder
  - 3D creation, e.g. extrude, revolve
  - 3D modify, e.g. hole, move face, chamfer
  - 3D Boolean, e.g. intersect, addition, subtraction
  - 3D assembly, e.g. place, constrain.
- Creation of 2D sketches, including basic shape, dimensioning, modifications and geometric constraints.
- 2D sketch to a 3D model, including rotate about an axis, revolve, extrude and Boolean manipulation.
- 3D features, including fillet and chamfer.
- Combination of solid objects, including Boolean operations.
- 2D sketching on 3D faces.
- Modification of the 3D model, including addition of features to existing geometry, e.g. move, projected geometry, extrusions.

B2 Developing a 3D component

- Placement of 3D components, including degrees of freedom, XYZ translational freedom and XYZ rotational freedom.
- Assembly constraints and the relationships between components, including angle constraint, insert constraint and tangent constraint, placing of texture, moving and rotating objects.
- Modification to 3D components due to assembly constraints.
- Consideration of assembly, including storyboarding and component relationship.

B3 Output of drawings from a model

- Drawings to be produced to current professional standards or industry standards relevant to the particular aspects of the design, e.g. British Standard EN ISO 11091:1999, British Standard BS 8888, The Landscape Institute (LI) standards, The Society of Garden Designers (SGD) standards, The Royal Institute of British Architects (RIBA) standards, or other appropriate international equivalents.
- 2D paper space, including drawing template, scale, size, title block and editing.
- Creation of component drawings, including an orthogonal base view and projected views, 3D solid model/surface model, appropriate scale, detail views, dimensioning, and centre lines.

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Learning aim C: Produce 2D construction detail plans and a planting schedule based on 3D features

C1 Construction detailing

- Configuration of the parametric modeller, e.g. origin, units, snap and grid, correct format, project files, selection of file types, planes such as XY, XZ and YZ.
- Extraction of 2D plan and 3D elements to a given layer, including basic shape, dimensioning, modifications and geometric constraints:
  - parameters, including use of offsets to created closed path paths, duplications and array
  - use of sketching commands, including line, arc, centre line, construction line, circle, fillet and dimension
  - use of construction commands for 3D modify, e.g. extrude, move, face.
- Use of call-out annotations for the provision of specification and technical information, e.g. mortar mixes, types of material to use, dimensions.

C2 Planting plan and plant schedule

- Configuration of planting zones using layer(s) for an area from 15 m^2 to include a tree, shrubs, herbaceous and bulb plants, e.g. seasonal interest border.
- Use of software graphics for plants:
  - selecting insert options, e.g. plant size, orientations, labelling.
- Data, e.g. plant data, images, planting distance, prices, pot sizes.
- Reports and schedule development
  - use of reports and spreadsheets to include quantities, Latin plant name, pot size, planting distance.
  - use of reporting options to provide maintenance care, unit price and images to communicate to installer or client.

C3 Output of product drawings

Drawings to be produced to relevant international standards.

- 2D paper space, including drawing template, scale, size, title block, editing.
- Creation of component drawings, including an orthogonal base view and projected views, 3D solid model/surface model, appropriate scale, detail views, rendered models, dimensioning, flat patterns and centre lines.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Produce a 2D computer-aided garden design plan		**A.D1** Produce a complex 2D survey plan using an imported image or DWG file that communicates existing features and refine, using layers, a 2D computer-aided drawing for a garden design to an international standard, presented with complete control of layers, editing and manipulation tools.
A.P1 Produce a basic 2D survey plan using an imported image or DWG file that communicates existing features. **A.P2** Produce, using layers, one 2D computer-aided drawing of a 150–250 m² garden design presented with basic manipulation and layer control.	**A.M1** Produce a complex 2D survey plan using an imported image or DWG file that communicates existing features. **A.M2** Produce, using layers, an accurate 2D computer-aided drawing containing a 150–250 m² garden design, presented with appropriate manipulation and layer control.	
Learning aim B: Produce a 3D element based on a computer-aided garden design plan		**B.D2** Refine, to an international standard, a 3D model of three 3D elements of a computer-aided garden design plan and three drawings of the 3D model with multiple viewports.
B.P3 Produce a 3D model of three 3D elements of the computer-aided garden design plan. **B.P4** Produce three drawings of the 3D model with multiple viewports.	**B.M3** Produce an accurate 3D model of three 3D elements of the computer-aided garden design plan and three drawings of the 3D model that mainly meet an international standard.	
Learning aim C: Produce 2D construction detail plans and a planting schedule based on 3D features		**C.D3** Refine, to an international standard, two 2D construction detail plans containing multiple 2D views and technical information, and a planting plan and schedule for a minimum 15 m² area.
C.P5 Produce two 2D construction detail plans containing multiple 2D views and technical information. **C.P6** Produce a planting plan and schedule for a minimum 15 m² area.	**C.M4** Produce two 2D construction detail plans containing multiple 2D views and technical information, and a planting plan and schedule for a minimum 15 m² area that mainly meets an international standard.	

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.M2, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M3, C.M4, B.D2, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- suitable CAD workstations and output devices, e.g. printers and plotters
- 2D CAD software that is capable of professional 2D drawings and their output, e.g. Vectorworks® Landmark, AutoCAD® 2D, TurboCAD® Deluxe
- 3D modelling software and output 2D drawings, e.g. Vectorworks® Landmark, AutoCAD® 3D, AutoCAD® Inventor®, SolidWorks®, and Google SketchUp (limited layering, ideal for direct modelling in 3D to scale).

Essential information for assessment decisions

Learning aim A

Learners will individually carry out a practical drawing activity to produce computer-aided 2D drawings of a garden design, using layers.

For Distinction standard, learners will produce a refined, accurate and detailed horticultural plan from a complex image or site conditions plan imported from an external source, such as Drawing Interchange Format (DXF) or Global Positioning System (GPS) data.

The horticultural plan will be for a landscaped garden design, complete with accurate scaling, to cover an area of 150 to 250 m². The design will contain a series of layers containing correctly orientated features, such as accurate annotations and different planting areas that have been produced in an accurate, efficient way. The plan will contain effective zoning and space allocation of a multiple array of garden features such as a patio, paths, pergola, water feature and planting areas. Layers will be used so that elements are grouped on one layer from the master layer. Another example would be a series of pathways with common elements but a differing series of variations in width, radii, end points and seasonal variations, which would be created from one master layer with the variations on separate layers to enable the production of several drawings.

Learners will select the most appropriate CAD commands, such as polyline, array, creation of symbols or the use of predefined symbols, mirroring, and polar, absolute and relative inputs, and use them highly effectively, for both drawing and editing purposes. They may be evidenced via screen dumps with supporting third-party observation.

Learners' portfolio of drawings will demonstrate a scaled, existing site conditions plan, a landscape garden design plan, screen dumps and supporting documentation. Overall, the drawings will be to an international standard as indicated in the unit content. Learners will produce extremely clear and accurate drawings that fully meet their purpose. The portfolio and its contents will be very clear for a third party to understand.

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For Merit standard, learners will produce an accurate horticultural plan from a complex image or site conditions plan imported from an external source, such as Drawing Interchange Format (DXF) or Global Positioning System (GPS) data.

The horticultural plan will be for a landscaped garden design, complete with mainly accurate scaling, to cover an area of 150 to 250 m². The design will contain a series of layers containing mostly well-orientated features, such as annotations and different lawn arrangements, which have been produced in a generally accurate way. The plan will contain generally clear zoning and space allocation of a multiple array of garden features such as a patio, paths, pergola, water feature and planting areas. Layers will be used so that elements are mainly grouped on one layer from the master layer. Another example would be a series of paving with common elements, such as by pattern or custom paving patterns, or created from a differing series of hatch patterns. These would be created from one master layer with the variations on separate layers to enable the production of several drawings.

Learners will generally select and use appropriate CAD commands, such as polyline, array, creation of symbols or the use of predefined symbols, mirroring, and polar, absolute and relative inputs, for both drawing and editing purposes. These may be evidenced via screen dumps with supporting third-party observation.

Learners' portfolio of drawings will demonstrate a scaled, existing site-conditions plan, a landscape garden design plan, screen dumps and supporting documentation. Overall, the drawings will be to an appropriate international standard, as indicated in the unit content. Learners will produce mainly clear, accurate drawings. Any inaccuracies in their technical approach will be minor. The evidence will contain generally well-orientated 2D components, with most elements on appropriate layers and appropriate control demonstrated in the use of editing and manipulation tools.

For Pass standard, learners will produce a horticultural plan from a basic image or site conditions plan imported from an external source, such as Drawing Interchange Format (DXF) or Global Positioning System (GPS) data.

The horticultural plan will be for a landscaped garden design, complete with scaling, to cover an area of 150 to 250 m². The design will contain a series of layers containing orientated features, such as annotations, and different plant graphics. The plan will show some realistic evidence of zoning and space allocation for a limited number of garden features. Elements will be created through the use of layers. There may however be some errors in learners' technical approach, for example layers that have been left frozen or only partially printed.

Learners will demonstrate limited understanding of CAD commands, such as polyline, array, creation of symbols or the use of predefined symbols, mirroring, and polar, absolute and relative inputs for both drawing and editing purposes. These may be evidenced via screen dumps with supporting third-party observation.

Learners' portfolio of drawings will demonstrate an existing site conditions plan, a landscape garden design plan, screen dumps and supporting documentation.

The portfolio of drawings will generally meet an appropriate international standard, as indicated in the unit content. The drawings may contain some errors in the drawing layout, title block and dimensioning. Overall, the evidence will demonstrate a 2D drawing that partially meets its purpose, with some correctly orientated 2D components. Most elements will be presented on layers and some control will be demonstrated in the use of editing and manipulation tools.

Learning aims B and C

In achieving learning aims B and C, learners will individually produce three 3D decorative landscape features from aspects of the 2D landscape garden design plan produced in achieving learning aim A. Learners will also individually produce two 2D construction detail plans for two of the 3D features, along with a planting plan and schedule.

For Distinction standard, learners will create a refined, consistently accurate set of three 3D decorative landscape features using aspects of their 2D landscape garden design plan. The evidence will show several refinements from the original model, with consistently effective and appropriate use of commands, such as array, extrude and revolve. The elements could include decorative landscape features, such as a pond structure or pergola. These will be assembled into a 3D model with the components orientated correctly. The faces of elements will be shown to represent an appropriate material, for example with the use of rendering or providing a textured finish.

Accurate drawing templates will be created to contain the three 3D models. These will show correctly orientated, multiple viewports that would enable the production of a professional portfolio of 3D drawings. The evidence will include a 3D shaded/solid model with multiple viewports. There will be robust evidence of refinements to each of the 3D models, such as the modification to 3D components due to assembly constraints, or due to an incorrect orientation in the XYZ axes.

Learners will create a portfolio of drawings to demonstrate the three 3D models and will show correctly orientated multiple viewports, screen dumps and supporting documentation. Overall, the portfolio of drawings will be to an international standard, as indicated in the unit content. The drawings will be very clear and accurate. Each of the 3D models should fully meet its purpose, for example to display a very straightforward and accurate visualisation to a potential customer and be very clear for a third party to understand. Learners will produce refined and accurate, detailed 2D construction detail plans for two of the 3D features. The 2D drawings will contain accurate representations of the 3D model in an orthographic layout, with all appropriate orthographic views created accurately. The final drawings will be created and produced to an appropriate scale, and dimensioned correctly. All text used in the drawing, including callouts (annotations) will be grammatically correct and accurate in terms of position and technical detail. The 2D drawings will contain a title block and border that is the correct size and technically accurate.

Learners will produce an accurate, refined planting plan for an area that is not less than 15 m^2. The plant schedule should be used to show the program plant graphics or custom graphics. The scale used will represent the plants' potential size and include details, such as plant spread, height, planting distance, random scaling and rotation. The planting plan will show several refinements from the original plan, such as differing plant heights or distances. The output will include a title block, border, callouts and tags which are grammatically correct and accurate in terms of position and technical detail.

Plant selection for the plan will identify a minimum of one tree species, five shrub species and fifteen herbaceous and/or bulb species with an accurate schedule to identify pot or plant size, and relevant plant information. Learners will also give information regarding basic maintenance requirements that will have been created accurately, with refinements added to develop the schedule.

Learners will create a drawing template to produce a professional portfolio of drawings, including appropriate orthographic drawings. The portfolio of drawings will meet a relevant international standard, as indicated in the unit content.

Overall, the portfolio will provide 2D drawings, a planting plan and a schedule that fully meet their purpose. The portfolio will display accurate information and visualisation to a potential customer, and will be very clear for a third party to understand.

For Merit standard, learners will create a mainly accurate set of three 3D decorative landscape features from aspects of their 2D landscape garden design plan. The evidence will show an appropriate use of commands, such as the Boolean commands for addition, subtraction and intersection. The elements could include decorative landscape features, such as a gazebo or pergola. These will be assembled into a 3D model with the components orientated correctly. The faces of elements will be shown to represent an appropriate material, for example with the use of rendering or providing a textured finish.

Mostly accurate drawing templates will be created to contain the three 3D models. These will show orientated multiple viewports that would enable the production of a professional portfolio of 3D drawings. Learners will include a 3D shaded/solid model with multiple viewports that evidences each of the 3D models.

Learners will create a portfolio of drawings to demonstrate the three 3D models, and will show orientated multiple viewports, screen dumps and supporting documentation. Overall, the portfolio of drawings will be produced mainly to a relevant international standard, as indicated in the unit content. The drawings may contain minor inaccuracies but should nevertheless generally meet their purpose, for example to display a visualisation to a potential customer.

Learners will produce mainly accurate, detailed 2D construction detail plans for two of the 3D features. The 2D drawings will contain accurate representations of the 3D model in an orthographic layout, with all appropriate orthographic views created accurately. The final drawings will be created and produced to an appropriate scale, and dimensioned correctly, although there may be minor inaccuracies, such as incorrectly positioned dimension lines. All text used in the drawings, including callouts (annotations) will be accurate in terms of position and technical detail. The 2D drawings will contain a title block and border that is the correct size and technically accurate.

Learners will produce an accurate planting plan for an area that is not less than 15 m^2. The plant schedule should be used to show the program plant graphics or custom graphics. The scale used in the plan will represent the plants' potential size and include information such as plant spread, height, planting distance, random scaling and rotation. The output will include a title block, border, callouts and tags that have been produced accurately in terms of position and technical detail.

Plant selection will identify a minimum of one tree species, five shrub species and fifteen herbaceous and/or bulb species with an accurate schedule to identify pot or plant size and relevant plant information. Learners will also give information regarding basic maintenance requirements that will have been created in a generally accurate way.

Learners will create a drawing template to produce a professional portfolio of drawings, including appropriate orthographic drawings. The portfolio of drawings will mostly meet a relevant international standard, as indicated in the unit content.

Overall, the portfolio will provide 2D drawings, a planting plan and a schedule that mainly meet their purpose. The portfolio will display mainly accurate information to a potential customer and will be clear for a third party to understand.

For Pass standard, learners will create a set of three 3D decorative landscape features from aspects of their 2D landscape garden design plan. Learners' evidence will show use of commands, such 3D primitives. The elements could include decorative landscape features, such as decking or paving with custom patterns. These will be assembled into a 3D model, with the components orientated correctly. The faces of some elements will be shown to represent an appropriate material, for example with the use of rendering or providing a textured finish.

Drawing templates will be created to contain the three 3D models. These will show multiple viewports that would enable the production of a portfolio of 3D drawings. Learners will include a 3D shaded/solid model with multiple viewports that evidences each of the 3D models.

Learners will create a portfolio of drawings to demonstrate the three 3D models, and will show orientated multiple viewports, screen dumps and supporting documentation. Overall, the portfolio of drawings will generally meet a relevant international standard, as indicated in the unit content. The drawings may contain some inaccuracies and will display a general visualisation to a potential customer.

Learners will produce detailed 2D construction detail plans for two of the 3D features. The 2D drawings will be a representation of the 3D model in an orthographic layout, with most of the appropriate orthographic views created. The final drawings will be created and produced to an appropriate scale, and dimensioned. There may be some inaccuracies, such as incorrect dimension lines or missing centre lines. The technical detail of text used in the drawing, including callouts (annotations), will be mainly accurate. The 2D drawings will contain a title block and border that is the correct size.

Learners will produce a planting plan for an area that is not less than 15 m^2. The plant schedule should be used to show the program plant graphics or custom graphics. The scale used in the plan will represent the plants' potential size, and include information such as plant spread, height, planting distance, random scaling and rotation. The planting plan may contain some discrepancies. The output will include a title block, border, callouts and tags that evidence appropriate technical details.

Plant selection will identify a minimum of one tree species, five shrub species and fifteen herbaceous and/or bulb species with an accurate schedule to identify pot or plant size and relevant plant information. Learners will also give information regarding basic maintenance requirements, although these will have been created with some errors.

Learners will create a drawing template to produce a portfolio of drawings, including appropriate orthographic drawings. The portfolio of drawings will generally meet a relevant international standard, as indicated in the unit content, however some errors will be evident.

Overall, the portfolio will provide 2D drawings, a planting plan and a schedule that generally meet their purpose.

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Links to other units

This unit links to:

- Unit 27: Identification, Planting and Care of Plants
- Unit 28: Routine Plant Management
- Unit 34: Identification, Planting and Care of Trees
- Unit 42: Landscape and Garden Design
- Unit 43: Constructing Decorative Landscape Features.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops
- masterclasses involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills when investigating computer-aided design garden plans
- personal skills when working with others
- self-management skills when carrying out 3D models.

Unit 46: Managing Soil Water

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners will explore the concepts of soil water and how to manage it using irrigation and drainage systems, in line with legal requirements.

Unit introduction

Effective management of an irrigation system requires understanding and use of the basic concepts of soil water. The goal of soil water management is to maintain the amount of water in the soil between field capacity and the minimal allowable water balance to satisfy plant requirements. Plants can suffer in soils above field capacity because of decreased aeration and nutrient leaching.

In this unit, learners will study the importance of soil water and how managing soil water is vital to the success of production goals. Learners will also develop skills in understanding, maintaining and assessing the drainage and irrigation requirements of horticultural and agricultural sites relevant to the local environment, and how this should be managed to meet legislative requirements.

This unit will prepare learners to work in the land-based sector and understand how soil and water interact, helping the environment to be managed to ensure successful production of produce. Learners will build on the concepts and challenges that they will study should they choose to progress onto a land-based higher-education programme of study.

Learning aims

In this unit you will:

A Explore the requirements of soil water management for land-based industries

B Maintain irrigation and drainage systems for land-based industries

C Understand the legal requirements applicable to irrigation and drainage for land-based industries.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore the requirements of soil water management for land-based industries	**A1** Soil water management **A2** Soil water relationships	A written report.
B Maintain irrigation and drainage systems for land-based industries	**B1** Maintenance of irrigation **B2** Maintenance of drainage systems	Project book and practical work supported by a written report.
C Understand the legal requirements applicable to irrigation and drainage for land-based industries.	**C1** Relevant legislation and guidance	

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Content

Learning aim A: Explore the requirements of soil water management for land-based industries

A1 Soil water management

- Soil structure and texture in relation to soil water:
  - soil types, e.g. platy, prismatic, columnar, blocky, single-grained, and granular
  - soil composition, including mineral solids, organic matter solids, water, and air
  - sand, silt, and clay and particular ratios that determine the soil texture
  - soil structure and soil water relationships
  - soil textural triangle
  - soil bulk density
  - soil porosity
  - soil drainage classifications.
- Field capacity, wilting point and soil moisture deficit.
- Relationships and possibilities of irrigation sources in relation to rainwater, rivers and lakes (and seasonal influences).

A2 Soil water relationships

- Basic soil water relationships that are important to consider for agricultural and horticultural management.
- Soil water content, including volumetric water content and gravimetric water content in cm^3 per gram.
- Soil water accessibility to plants.
- Soil water potential:
  - potential energy
  - adhesion, surface tension, and cohesion
  - capillary suction
  - total water potential, matric potential, gravitational potential and pressure potential.

Learning aim B: Maintain irrigation and drainage systems for land-based industries

B1 Maintenance of irrigation systems

- Inspection of automatic systems and mobile systems.
- Repair or replace a nozzle.
- Track down faults in the system.
- Routine and annual maintenance of automatic irrigation systems and of mobile irrigation systems.
- Benefits of different irrigation systems.

B2 Maintenance of drainage systems

- Different drainage systems: surface drainage and sub-surface drainage.
  - Perimeter open field ditches
  - In field surface grips, drains, rills or other relict shallow drainage features
  - In field subsurface drainage pipes
  - Mole drains
  - Bunds, banks or embankments.

- Component parts of pipe drainage.
- Manage and install pipe drainage systems to achieve desired flow rates.
- Backfill materials for pipe drains.
- Sand infiltration systems.
- Routine maintenance by inspection of drainage systems.
- Fault find and carry out routine repairs.
- Annual maintenance considerations of drainage systems.

Learning aim C: Understand the legal requirements applicable to irrigation and drainage for land-based industries

C1 Relevant legislation and guidance

- Current legislation covering irrigation and drainage:
  - local and national legislative requirements
  - codes of practices and guidance for agriculture or horticulture operations.
- Record keeping for water abstraction, drainage activities, use of grey water and water use.
- Rules for water abstraction and drainage activities.

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Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Explore the requirements of soil water management for land-based industries</td><td rowspan="2">A.D1 Evaluate the function and physical properties of soil and soil water.</td></tr>
<tr><td>A.P1 Explain the function of soil water in environmental management.
A.P2 Identify the physical properties of soil and soil water.</td><td>A.M1 Analyse the function and physical properties of soil and soil water.</td></tr>
<tr><td colspan="2">Learning aim B: Maintain irrigation and drainage systems for land-based industries</td><td rowspan="4">BC.D2 Evaluate irrigation and drainage systems used in horticulture or agriculture and the national legislative requirements.</td></tr>
<tr><td>B.P3 Identify common irrigation and drainage systems used in horticulture or agriculture.
B.P4 Demonstrate maintenance of irrigation and drainage systems used in horticulture or agriculture.</td><td>B.M2 Assess and maintain common irrigation and drainage systems used in horticulture or agriculture.</td></tr>
<tr><td colspan="2">Learning aim C: Understand the legal requirements applicable to irrigation and drainage for land-based industries</td></tr>
<tr><td>C.P5 Outline the national legislative requirements for irrigation and drainage in horticulture and agriculture.</td><td>C.M3 Explain the national legislative requirements for irrigation and drainage in horticulture and agriculture.</td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of 2 summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, B.M2, C.M3, and BC.D2)

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Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to land and soil water, and irrigation and drainage systems in a variety of contexts.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will produce a written report that shows they have fully evaluated the function of soils and soil water, along with a comprehensive review of the physical properties of soil and soil water in at least three different soil types, in either agricultural or horticultural enterprises. Learners will evidence their depth and breadth of understanding of soil structure and texture, field capacity and relationships. The learner's report will be well structured and use a suitable format, with use of wider sources of information and data.

For Merit standard, learners will produce a written report that shows they have analysed the function of soils and soil water, along with suitable explanations of the physical properties of soil and soil water in at least three different soil types, in either agricultural or horticultural enterprises. Learners will evidence some depth and breadth of understanding of soil structure and texture, field capacity and relationships. The learner's report will be structured and use a suitable format, with use of wider sources of information and some data.

For Pass standard, learners will produce a written report that shows they can identify the function of soils and soil water, along with limited explanations of the physical properties of soil and soil water in at least three different soil types, in either agricultural or horticultural enterprises. Learners will have limited depth and understanding of soil structure and texture, field capacity and relationships. The learner's report will be structured and use a suitable format, with limited use of wider sources of information and some data.

Learning aims B and C

For Distinction standard, learners will produce a project portfolio of evidence along with a short report. The project portfolio will be completed with robust photographic evidence of the learner's practical knowledge of assessing and maintaining irrigation and drainage systems. Learners will show significant breadth and depth of knowledge and understanding in a single agricultural or horticultural enterprise, with accurate application and demonstration of working within the national and local legislative requirements. Learners will also be evaluative and critical in their approach. The learner will be meticulous in their approach and produce a well-structured report to complement their assessment and maintenance of irrigation and drainage systems in an appropriate context.

For Merit standard, learners will produce a project portfolio of evidence along with a short report. The project portfolio will be completed with suitable photographic evidence of the learner's practical knowledge of assessing and maintaining irrigation and drainage systems. Learners will show reasonable breadth and depth of knowledge and understanding in a single agricultural or horticultural enterprise, with mostly accurate application, with some errors. They will demonstrate working within the national and local legislative requirements relevant for the context. The learner will explain their approach and have a structured report to complement their assessment and maintenance of irrigation and drainage systems in an appropriate context.

For Pass standard, learners will produce a project portfolio of evidence along with a short report. The project portfolio will be completed with suitable photographic evidence of the learner's practical knowledge of assessing and maintaining irrigation and drainage systems. Learners will show limited breadth and depth of knowledge in a single agricultural or horticultural enterprise, with limited application and errors. They will demonstrate limited working within the national and local legislative requirements. The learner will explain their approach and have a structured report to complement their assessment and maintenance of irrigation and drainage systems in an appropriate context.

Links to other units

This unit links to *Unit 1: Plant and Soil Science*.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops
- masterclasses involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have the opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills when investigating how soil water is managed
- personal skills when working with others
- self-management skills when carrying out irrigation and drainage systems.

Unit 47: Sustainable and Renewable Land-based Practices

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners will explore the concepts of land-based waste products and use of renewable energy and energy reduction technology.

Unit introduction

Renewable energy and production methods are a winning combination in agriculture and horticultural practices. Wind, solar, and biomass energy can be harvested forever, providing communities with a long-term source of income and resulting goods. Renewable energy can be used to replace other fuels or sold as renewable primary materials.

In this unit, learners will identify the renewable energy systems suitable for use in an agricultural environment and examine the feasibility of adopting technologies in different contexts. Learners will explore the environmental impacts of agriculture or horticulture on the land, water and air. Learners will understand and identify methods of reducing environmental impacts from agriculture or horticulture.

This unit will prepare learners to work in the land-based sector and understand how renewable energy and practices are helping the environment to be managed to ensure successful production of produce. Learners can build on the concepts and challenges that they will study should they choose to progress onto a land-based higher-education programme of study.

Learning aims

In this unit you will:

A Explore waste and waste products arising from different land-based operations

B Plan renewable environmental management strategies for land-based operations

C Understand passive and active energy reduction technologies and their feasibility for implementation.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Explore waste and waste products arising from different land-based operations	**A1** Waste products arising from different agricultural or horticultural operations **A2** Waste management	An informative conference poster.
B Plan renewable environmental management strategies for land-based operations	**B1** Renewable energy for agriculture and horticulture **B2** Energy planning	A feasibility study and energy planning document.
C Understand passive and active energy reduction technologies and their feasibility for implementation	**C1** Energy reduction	

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Content

Learning aim A: Explore waste and waste products arising from different land-based operations

A1 Waste products arising from different agricultural or horticultural operations

- Waste from current agricultural and horticultural operations:
  - livestock waste, including effluents, manure and animal carcasses
  - sediment and nutrient runoff
  - oils
  - plastics, e.g silage plastics, plastic twine
  - food processing waste
  - crop and plant waste (green waste)
  - fertiliser
  - pesticides and herbicides
  - hazardous and toxic waste.
- Problems with types of waste, including long-term environmental impacts, economic impacts and degradability.
- Pollutants and hazards.
- Effects of the production system on soil, water and air, including:
  - the environmental impacts of fertiliser use/storage, pesticide use/storage, fuel use/storage and slurry/manure use/storage.

A2 Waste management

- Processing waste:
  - separation, sorting and storing waste
  - composting
  - biomass
  - anaerobic digesters
  - recycling of suitable materials
  - incineration locally with/ without energy recovery
  - re-use
  - strengths and limitations of each option.
- Reducing waste:
  - waste minimisation benefits
  - incentives and awareness programmes
  - best practice and legal requirements of waste reduction and management
  - environmental management plans and reviewing current practices for efficiency and optimisation.

Learning aim B: Plan renewable environmental management strategies for land-based operations

B1 Renewable energy for agriculture and horticulture

- Types of renewable energy, e.g solar, wind, hydro, biogas, energy recovering schemes.
- Impact of activities on land, water and air.
- Renewable energy options for electricity production.
- Renewable energy options suitable for heat generation.
- Energy usage and inefficiencies.
- Sustainability and reliability of renewables.

B2 Energy planning

- Financial support for renewable energy production.
- Plans for energy recovery from land-based waste.
- Carbon reduction.

Learning aim C: Understand passive and active energy reduction technologies and their feasibility for implementation

C1 Energy reduction

- Options for energy reduction by:
  - changing practices
  - retrofit of passive systems
  - use of technology.
- Current technologies for renewable electricity production and heat production.
- Incentives to install renewable energy systems.
- Recommendations for systems to use.
- Feasibility (including payback) of adopting renewable production technologies.

Assessment criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">Learning aim A: Explore waste and waste products arising from different land-based operations</td><td rowspan="2">A.D1 Analyse in detail the types of waste produced and how they are processed in agriculture or horticulture.</td></tr>
<tr><td>A.P1 Identify the types of waste produced in agriculture or horticulture.
A.P2 Explain how waste products are processed in agriculture or horticulture.</td><td>A.M1 Analyse the types of waste produced and how they are processed in agriculture or horticulture.</td></tr>
<tr><td colspan="2">Learning aim B: Plan renewable environmental management strategies for land-based operations</td><td rowspan="4">BC.D2 Evaluate renewable strategies for energy production and energy reduction technologies, and the feasibility of implementation in agriculture or horticulture.</td></tr>
<tr><td>B.P3 Outline renewable energy strategies.
B.P4 Plan a renewable environmental strategy for energy production.</td><td>B.M2 Assess renewable energy strategies and renewable environmental strategies for energy production.</td></tr>
<tr><td colspan="2">Learning aim C: Understand passive and active energy reduction technologies and their feasibility for implementation</td></tr>
<tr><td>C.P5 Outline passive and active energy reduction technologies in agriculture or horticulture.
C.P6 Explain the feasibility of implementing reduction technologies.</td><td>C.M3 Explain energy reduction technologies and the feasibility of implementation in agriculture or horticulture.</td></tr>
</table>

Essential information for assignments

The recommended structure of assessment is shown in the unit summary, along with suitable forms of evidence. *Section 6 Internal assessment* gives information on setting assignments and there is also further information on our website.

There is a maximum number of two summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, B.M2, C.M3, BC.D2)

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Further information for teachers and assessors

Resource requirements

There are no special resources needed for this unit.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will produce a well-structured and detailed informative poster of conference standard. The work will show that the learner has excellent depth and breadth of knowledge and has applied theory in two different contexts, either both in agriculture or horticulture or a mixture of the two. The learner will make clear, accurate and comprehensive statements relevant to the contexts identified. Learners will demonstrate the ability to produce industry-standard work in a specific format and be meticulous in their approach and presentation.

For Merit standard, learners will produce a suitably structured and detailed informative poster of conference standard. The work will show that the learner has reasonable depth and breadth of understanding and has applied theory in two different contexts, either both in agriculture or horticulture or a mixture of the two. The learner will make mostly clear and accurate statements relevant to the contexts identified. Learners will demonstrate the ability to produce industry-standard work in a specific format and be detailed in their approach and presentation.

For Pass standard, learners will produce a structured piece of work with limited detail. The work will show that the learner has limited ability to include depth and breadth of knowledge and has applied some theory in two different contexts, either both in agriculture or horticulture or a mixture of the two. The learner will make limited, clear statements relevant to the contexts identified. Learners will demonstrate the ability to produce industry-standard work in a specific format, which contains unsubstantiated statements and facts, with reasonable approach and presentation.

Learning aims B and C

For Distinction standard, learners will produce a written assessment that shows they have a robust approach to researching and producing planning documents based on secondary research. Learners will show that they have explored the topics in significant depth and breadth, with strong knowledge and understanding evident. Learners will demonstrate a clear approach to researching renewable strategies for energy production and energy reduction technologies and will determine the feasibility of implementing these within a given agricultural or horticultural enterprise. Learners will make clear and relevant conclusions based on sound research.

For Merit standard, learners will produce a written assessment that shows they have a clear approach to researching and producing planning documents based on secondary research. Learners will show that they have explored the topic in some depth and breadth, with reasonable knowledge and understanding evident. Learners will demonstrate a mostly clear and logical approach to researching renewable strategies for energy production and energy reduction technologies and will determine the feasibility of implementing these within a given agricultural or horticultural enterprise. Learners will make clear and mostly relevant conclusions based on sound research.

For Pass standard, learners will produce a written assessment that shows they have a basic approach to researching and producing planning documents based on secondary research, which demonstrate limited wider background research. Learners will show that they have explored the topic in limited depth and with very limited breadth. Learners will demonstrate a mostly clear but confused approach to researching renewable strategies for energy production and energy reduction technologies and will determine the feasibility of implementing these within a given agricultural or horticultural enterprise. Learners will make limited conclusions that are not based on sound research.

Links to other units

This unit links to:

- Unit 6: Land-based Business Improvements
- Unit 7: Work Experience in the Land-based Sectors.

Employer involvement

This unit would benefit from employer involvement in the form of:

- technical workshops
- masterclasses involving staff from local land-based organisations
- contribution of ideas to unit assignment/project materials
- observation during work experience
- support from a local land-based organisation's staff as mentors.

Opportunities to develop transferable employability skills

Learners will have opportunities to develop the following transferable skills in the completion and assessment of this unit:

- research skills
- presentation skills
- written and verbal communication skills.

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Unit 48: Specialist Tourism

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners research and analyse the scale, size and scope of specialist tourism in the travel and tourism industry, including key specialist providers, recent trends and types of specialist tourism.

Unit introduction

Specialist tourism is a growing area of the travel and tourism industry, with more niche markets appearing year on year.

In this unit, you will investigate the scale and scope of specialist tourism and its significance in the travel and tourism industry. You will identify the current key players and their specialisms, and consider specific current trends. Finally, you will look at established and emerging specialisms and their appeal to, and popularity with, differing markets.

This unit will help you progress to higher education to a variety of courses that require knowledge of specialist customer markets, for example a degree in tourism, leisure, business studies. The wide range of skills and knowledge you will develop in this unit will also help you to progress in your career.

Learning aims

In this unit you will:

A Investigate the variety of specialist tourism choices and providers

B Explore the scale, scope and growth of specialist tourism

C Examine the durability and potential impact of key types of specialist tourism.

Summary of unit

Learning aim	Key content areas	Assessment approach
A Investigate the variety of specialist tourism choices and providers	**A1** Definition of specialist tourism **A2** Independent tour operators **A3** Mass-market tour operators that have entered this market **A4** The Association of Independent Tour Operators (AITO) and its members **A5** The impact of online travel agencies (OTAs) and online booking on specialist tourism	A report investigating the variety of providers in the specialist tourism sector and their different roles. Focusing on four different attractions (two natural and two built), the report will also investigate the role of OTAs and online booking in these choices.
B Explore the scale, scope and growth of specialist tourism	**B1** Customer demographic taking specialist tourism holidays **B2** Growth of numbers in specialist tourism from the UK, Europe and worldwide (through the 21st century) **B3** Types of holiday and destination in specialist tourism **B4** The role of media and review sites in the development of specialist tourism	A presentation with accompanying maps, graphs or charts, which considers the demographic trends, role of media and review sites, and identification of key destinations for specialist tourism.
C Examine the durability and potential impact of key types of specialist tourism	**C1** Specialisms with durability and contemporary specialism choices **C2** Longevity of destination **C3** Potential impact of specialist tourism on destination	A presentation with accompanying speaker notes, focusing on the durability and potential impact of key types of specialist tourism on a destination in relation to three specialist areas.

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Content

Learning aim A: Investigate the variety of specialist tourism choices and providers

A1 Definition of specialist tourism

- Specialist tourism is the provision of customised tourism activities that cater for the specific interests of groups and individuals. The range of specialist tourism is vast and rapidly changing, e.g.:
  - adventure, ancestry, architectural (architourism), art and design, astro, bird watching (avitourism), battlefields, cultural, dark, eco, e-gaming, festivals/events, film, gambling, gap year, gastronomy, geographical (storm chasing, Aurora Borealis), ghost sites, health and wellbeing, heritage, historic, lesbian gay bisexual transgender (LGBT), lighthouse, linguistics, medical, military, nature, nostalgia, photographic, property, religious, rural, safari, senior, slum sites, spa/health, sport spectating/sport participation, terrorism sites, virtual, volunteering, wedding, wildlife, wine.
- Customised tourism categories:
  - exploration
  - adventure
  - learning.
- Appeal and target markets, customer demographic.
- Worldwide attractions relevant to specialist tourism:
  - natural attractions
    - topographic sites, e.g. mountains, beaches, valleys, caves, canyons, volcanoes, reefs
    - climatic sites, e.g. hot places, cold places, humid places, dry places
    - sites defined by location, e.g. central or accessible sites, isolated or difficult-to-access sites
    - sites that feature certain plant or animal life, e.g. forests, jungles, grasslands, meadows, deserts, botanical gardens
    - hydrological sites, e.g. lakes, rivers, streams, waterfalls, mineral springs
    - natural events, e.g. eclipse of the moon, seasonal occurrences such as animal and bird migrations, volcanic eruptions, rainy or dry season and changes in sea conditions
  - built attractions
    - prehistoric, e.g. ancient monuments, cave paintings
    - historic, e.g. museums, monuments, heritage-listed buildings, sites of significant events
    - religious sites of significance, e.g. holy sites, sites of pilgrimage, religious festivals
    - contemporary cultural displays and events, e.g. museums, art galleries, modern architecture, theatre, festivals, fairs, exhibitions, international sporting events
    - rural attractions, e.g. farms, wineries, mines, agricultural regions, agricultural technology or museums.

A2 Independent tour operators

- Established specialist tour operators and their market niche.
- New specialist tour operators and their market niche.
- The importance, benefits and issues associated with independent tour operators.

A3 Mass-market tour operators that have entered this market

- The potential benefits for mass-market tour operators in entering the specialist tourism market.
- The potential issues that arise for independent tour operators as a result of the entry of mass-market tour operators.
- The potential benefits, importance and issues that arise from the entry of mass-market tour operators for customers.

A4 The Association of Independent Tour Operators (AITO) and its members

- Uses (including potential benefits and problems) for AITO members.
- Uses (including potential benefits and problems) for the customers of travel and tourism organisations.
- Role of AITO in the travel and tourism industry.

A5 The impact of online travel agencies (OTAs) and online booking on specialist tourism

Current OTAs and online-booking facilities and their role in specialist tourism:

- types of online-booking facility
- types of customer using OTAs
- OTA marketing and market share
- OTA trends and potential impact in specialist tourism, including future use of OTAs.

Learning aim B: Explore the scale, scope and growth of specialist tourism

B1 Customer demographic taking specialist tourism holidays

- Customer profiles.
- Numbers of travellers.

B2 Growth of numbers in specialist tourism from the UK, Europe and worldwide (through the 21st century)

- Reasons for growth, e.g. the internet, changes in disposable income, growth of budget air travel, customer awareness.
- Possible trends/developments for growth of volume/numbers:
  - population and social change
  - ageing population, vertical family, untraditional families, baby boomers, squeezed-middle generation
  - intergenerational holidays
  - changing ethnic profile of countries.

B3 Types of holiday and destination in specialist tourism

- Holidays that fall into the category of specialist tourism.
- Customer demographic:
  - how choice of destination is influenced by customer demographic.
- Key destinations for specialist travellers:
  - definition of key destinations – the most popular destinations for specialist travellers
  - reasons for appeal of key destinations.

- Key source regions for specialist travellers:
  - definition of key source regions – the most popular source regions for specialist travellers
  - reasons for key source region popularity.

B4 The role of media and review sites in the development of specialist tourism

Current social media and review sites, and their role in specialist tourism:

- types of customer using social media and review sites
- use of social media sites by customers and the potential impact on specialist tourism
- use of review sites by customers and the potential impact on specialist tourism
- use of social media and review sites as a tool in marketing specialist tourism to different market segments.

Learning aim C: Examine the durability and potential impact of key types of specialist tourism

C1 Specialisms with durability and contemporary specialism choices

- Variation in the durability (duration of popularity) of specialist tourism activities that cater for the specific interests of groups and individuals.
- Variation in the potential impact on tourist destinations resulting from the duration of the popularity of specialist tourism activities.

C2 Longevity of destination

Duration of popularity:

- why specialist destinations have different timescales of popularity
- specialisms with a long period of popularity
- time-limited specialisms
- potential impact of length of popularity/time-limited specialisms.

C3 Potential impact of specialist tourism on destination

Potential impact:

- economic, e.g. short- and/or long-term boost to local economy
- infrastructure development, e.g. resulting from an event such as the Olympic Games
- socio-economic and demographic changes
- demographic range of individuals travelling to destinations
- ecological or environmental.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate the variety of specialist tourism choices and providers		
A.P1 Explain the variety of specialist tourism choices available to customers, referring to two natural attractions and two built attractions. **A.P2** Compare the roles of different types of specialist tourism provider in the sector.	**A.M1** Analyse specialist tourism choices available to customers and the role of different types of specialist tourism provider.	**A.D1** Evaluate the importance of different types of specialist provider in the sector.
Learning aim B: Explore the scale, scope and growth of specialist tourism		
B.P3 Explain demographic trends in specialist tourism and the role of media and review sites in the development of specialist tourism. **B.P4** Identify two key destinations for one area of specialist tourism.	**B.M2** Assess the development of one area of specialist tourism, referring to demographic trends, the role of media and review sites and key destinations.	**B.D2** Evaluate the importance of demographic trends, media and review sites and key destinations in the growth of one area of specialist tourism.
Learning aim C: Examine the durability and potential impact of key types of specialist tourism		
C.P5 Assess why there are variations in the durability of different types of specialist tourism. **C.P6** Explain how the durability of three different types of specialist tourism may potentially impact on a destination.	**C.M3** Analyse why the durability of three different types of specialist tourism activities may be limited and their potential impact on a destination.	**C.D3** Evaluate the importance of durability in the potential impact of three different types of specialist tourism on a destination.

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Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of three summative assignments for this unit.
The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aim: B (B.P3, B.P4, B.M2, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- up-to-date information online, including statistics relating to specialist tourism numbers and resources to explore numerous types of tourist activity as given in the unit content
- paper-based information, such as brochures from travel agencies, as well as access to online brochures or travel and tourism websites
- maps and atlases.

Essential information for assessment decisions

Learning aim A

For Distinction standard, learners will thoroughly evaluate the importance of different types of specialist provider in this area of the travel and tourism industry. The evidence will be logically structured and make use of sector-specific terms. It will give a convincing evaluation of the contribution of the specialist tourism provider and mass-market tour operators, providing valid conclusions and recommendations. Learners will select a range of contrasting specialist tourism holidays (four in total – two natural attractions and two built attractions located in different geographical regions) and give a comprehensive evaluation of each. The evidence will demonstrate high-quality written/oral communication through use of accurate and fluent vocabulary to support a well-structured and considered response.

For Merit standard, learners will give a clear analysis of the specialist tourism choices available and the role of specialist tourism providers in this area of the travel and tourism industry. The evidence will provide a methodical explanation of the role of the specialist tourism provider and mass-market tour operators. Two natural and two built attractions will be selected, however they may be quite similar, for example located in similar geographical regions. The evidence will be structured, with good-quality written communication and use of appropriate terminology.

For Pass standard, learners will explain the variety of specialist tourism choices available to customers and compare the role of the different types of specialist tourism provider. The evidence will contain minimal but acceptable structure and will provide an appropriate explanation of the role of the specialist tourism provider and mass-market tour operators. Two natural and two built attractions will be selected, however superficial consideration may have been given to the reasons for selection and the selections may not be strongly contrasting. Learners' explanations may be limited and the focus may lack breadth.

Learning aim B

For Distinction standard, learners will give a thorough, valid evaluation of the importance of demographic trends in specialist tourism, the influence of media and review sites on the development of specialist tourism and two key destinations in the growth of an area of specialist tourism. The presentation of the evidence will be clear, professional, accurate and entirely appropriate. Data and other evidence used to support the evaluation will be completely relevant and the reasons for their inclusion will be fully explained. The evidence will demonstrate high-quality written communication through use of accurate and fluent vocabulary to support a well-structured and considered response.

For Merit standard, learners will give a clear, balanced assessment of the development of specialist tourism. Clear, relevant references will be made to the roles of demographic trends in media and review sites, and two key destinations for an area of specialist travel and tourism. Data and other evidence used to support the evaluation will be relevant and the reasons for their inclusion will be clearly explained. The evidence will make use of appropriate terminology and demonstrate good-quality written or oral communication.

For Pass standard, learners will explain demographic trends in specialist tourism and the role of media and review sites in the development of specialist tourism. They will identify two destinations contributing to the growth of a particular area of the specialist travel and tourism sector. Learners' explanations of demographic trends and the role of media and review sites will show an understanding of most of the key factors but may be superficial in parts or make limited use of data and other supporting evidence.

Learning aim C

For Distinction standard, learners will give a robust evaluation of the importance of durability in the potential impact of three different types of specialist tourism on a selected destination. The evaluation will focus on the specific impacts that the durability of each specialist type of tourism has on the selected destination. The evidence will cover three specialist areas and will clearly evaluate the potential impact of the duration of popularity on the specialist tourist destination, its importance and activities. The relationship between potential impacts and their strength or scope will be thoroughly investigated. Learners will make effective judgements about the relative importance of durability in the three different specialist contexts, drawing on the results of their investigations. The evidence will demonstrate high-quality written/oral communication through use of accurate and fluent vocabulary to support a well-structured and considered response.

For Merit standard, learners will provide a clear, balanced analysis of why the durability of three different types of specialist tourism activity may be time-limited and the potential impact of durability on a selected destination. The evidence will focus on three specialist areas, providing clear detail of the potential impact of the duration in popularity of these specialist areas. The impacts will be considered in terms of their effects on the specialist tourist destination, its importance and activities. The evidence will be structured, with good-quality written communication and use of appropriate terminology.

For Pass standard, learners will assess why there are variations in the durability of three different types of specialist tourism. They will explain the potential impact on a selected destination of the durability of three different types of specialist tourism. The evidence will focus on three specialist areas and give a realistic explanation of the potential impact of the durability of these three specialist areas on the selected tourist destination, its importance and activities. The explanation of the potential impacts on the destination may be unbalanced, superficial or generic in parts. Learners will show an understanding of most of the factors but may make limited use of supporting evidence for their explanations.

Links to other units

This unit links to:

- Unit 4: Developing a Land-based Enterprise
- Unit 6: Land-based Business Improvements.

Employer involvement

This unit would benefit from employer involvement in the form of:

- guest speakers
- work experience
- own organisation's materials as exemplars
- support from local travel and tourism staff as mentors.

Opportunities to develop transferable employability skills

Learners will have opportunities to develop the following transferable skills in the assessment of this unit:

- research skills
- presentation skills
- written and verbal communication skills.

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4 Planning your programme

How do I choose the right BTEC International Level 3 qualification for my learners?

BTEC International Level 3 qualifications come in a range of sizes, each with a specific purpose. You will need to recruit learners very carefully to ensure that they start on the right size of qualification to fit into their study programme and that they take the right pathways or optional units to allow them to progress to the next stage.

Some learners may want to take a number of complementary qualifications or keep their progression options open. These learners may be suited to taking a BTEC International Level 3 Certificate or Subsidiary Diploma. Learners who then decide to continue with a fuller vocational programme can transfer to a BTEC International Level 3 Diploma or Extended Diploma.

Some learners are sure of the sector in which they wish to work and are aiming for progression into that sector via higher education. These learners should be directed to the two-year BTEC International Level 3 Extended Diploma as the most suitable qualification.

Is there a learner entry requirement?

As a centre, it is your responsibility to ensure that the learners you recruit have a reasonable expectation of success on the programme. There are no formal entry requirements but we expect learners to have qualifications at or equivalent to Level 2.

Learners are most likely to succeed if they have:

- five International GCSEs at good grades and/or
- BTEC qualification(s) at Level 2
- other appropriate qualifications or achievement at year 11 or age 16 in core subjects.

Learners may demonstrate the ability to succeed in various ways. For example, they may have relevant work experience or specific aptitude shown through diagnostic tests or non-educational experience.

If learners are studying in English we recommend that they have attained at least Level B2 in the Common European Framework of Reference for Languages or Pearson Global Scale of English 51. Please see resources available from Pearson at www.pearson.com/english

What is involved in becoming an approved centre?

All centres must be approved before they can offer these qualifications – so that they are ready to assess learners and so that we can provide the support that is needed. Further information is given in *Section 8 Quality assurance*.

What level of sector knowledge is needed to teach these qualifications?

We do not set any requirements for teachers but recommend that centres assess the overall skills and knowledge of the teaching team to ensure that they are relevant and up to date. This will give learners a rich programme to prepare them for employment in the sector.

What resources are required to deliver these qualifications?

As part of your centre approval, you will need to show that the necessary material resources and work spaces are available to deliver BTEC International Level 3 qualifications. For some units, specific resources are required.

How can Pearson Progress help with planning for these qualifications?

Pearson Progress is a digital support system that supports the delivery, assessment and quality assurance of BTECs in centres. It supports teachers with activities such as course creation, creating and verifying assignments and creating assessment plans and recording assessment decisions.

For further information, see *Section 10 Resources and support*.

Which modes of delivery can be used for these qualifications?

You are free to deliver BTEC International Level 3 qualifications using any form of delivery that meets the needs of your learners. We recommend making use of a wide variety of modes, including direct instruction in classrooms or work environments, investigative and practical work, group and peer work, private study and e-learning.

What are the recommendations for employer involvement?

BTEC International Level 3 qualifications are vocational qualifications and, as an approved centre, you are encouraged to work with employers on design, delivery and assessment to ensure that it is engaging and relevant, and that it equips learners for progression. There are suggestions in many of the units about how employers could become involved in delivery and/or assessment but these are not intended to be exhaustive and there will be other possibilities at local level.

What support is available?

We provide a wealth of support materials, including curriculum plans, delivery guides, sample Pearson Set Assignments, Authorised Assignment Briefs and examples of marked learner work.

You will be allocated a Standards Verifier early on in the planning stage to support you with planning your assessments. There will be extensive training programmes as well as support from our Subject Advisor team.

For further details see *Section 10 Resources and support*.

Meeting local needs

Centres should note that the qualifications set out in this specification have been developed in consultation with centres and employers for the relevant sector. Centres should make maximum use of the choice available to them within the optional units to meet the needs of their learners, and local skills and training needs.

In certain circumstances, units in this specification might not allow centres to meet a local need. In this situation, Pearson will allow centres to either make use of units from other BTEC specifications in this suite, or commission new units to meet the need. Centre developed units will need to be quality assured by Pearson at a cost. Centres are required to ensure that the coherence and purpose of the qualification is retained and to ensure that the vocational focus is not diluted.

The proportion of imported, or locally developed units that can be used are as follows. These units cannot be used at the expense of the mandatory units in any qualification.

Qualification	Meeting local needs allowance	Unit equivalence
Certificate (180 GLH)	No MLN allowed	0 units
Subsidiary Diploma (360 GLH)	60 GLH MLN allowed	1 * 60 GLH unit
Foundation Diploma (540 GLH)	120 GLH MLN allowed	e.g. 2 * 60 GLH units
Diploma (720 GLH)	180 GLH MLN allowed	e.g. 3 * 60 GLH units
Extended Diploma (1080 GLH)	240 GLH MLN allowed	e.g. 4 * 60 GLH units

How will my learners become more employable through these qualifications?

BTEC International Level 3 qualifications are mapped to relevant occupational standards, please see *Appendix 1*: *Links to industry standards*.

Employability skills, such as team working and entrepreneurialism, and practical, hands-on skills have been built into the design of the learning aims and content. This gives you the opportunity to use relevant contexts, scenarios and materials to enable learners to develop a portfolio of evidence that demonstrates the breadth of their skills and knowledge in a way that equips them for employment.

5 Assessment structure

Introduction

BTEC International Level 3 qualifications are assessed using a combination of *internal assessments*, which are set and marked by teachers, and *Pearson Set Assignments*, which are set by Pearson and marked by teachers.

- Mandatory units have a combination of internal and Pearson Set Assignments.
- All optional units are internally assessed.

In developing an overall plan for delivery and assessment for the programme, you will need to consider the order in which you deliver units, whether delivery is over short or long periods and when assessment can take place. You must plan the assignments so that learners can demonstrate learning from across their programme.

We have addressed the need to ensure that the time allocated to final assessment of units is reasonable so that there is sufficient time for teaching and learning, formative assessment and development of transferable skills.

In administering an internal assignment or a Pearson Set Assignment, the centre needs to be aware of the specific procedures and policies that apply, for example to registration, entries and results. An overview, with signposting to relevant documents, is given in *Section 7 Administrative arrangements*.

Internal assessment

Our approach to internal assessment for these qualifications will be broadly familiar to experienced centres. It offers flexibility in how and when you assess learners, provided that you meet assessment and quality assurance requirements. You will need to take account of the requirements of the unit format, which we explain in *Section 3 Units*, and the requirements for delivering assessment given in *Section 6 Internal assessment*.

Pearson Set Assignment units

A summary of the set assignments for this qualification is given in *Section 2 Structure*. You should check this information carefully, together with the details of the unit being assessed, so that you can timetable learning and assessment periods appropriately.

Learners must take the authorised Pearson Set Assignment for the set assignment unit. Teachers are not permitted to create their own assessments for set assignment units. Some assignments may need to be taken in controlled conditions. These are described in each unit.

Please see *Section 6* for resubmission and retaking regulations.

6 Internal assessment

This section gives an overview of the key features of internal assessment and how you, as an approved centre, can offer it effectively. The full requirements and operational information are given in the *BTEC International Quality Assurance Handbook*. All members of the assessment team need to refer to this document.

For BTEC International Level 3 qualifications, it is important that you can meet the expectations of stakeholders and the needs of learners by providing a programme that is practical and applied. Centres can tailor programmes to meet local needs and use links with local employers and the wider vocational sector.

When internal assessment is operated effectively, it is challenging, engaging, practical and up to date. It must also be fair to all learners and meet international standards.

All units in these qualifications are internally assessed but Pearson sets assignments for some units.

Principles of internal assessment (applies to all units)

Assessment through assignments

For all units, the format of assessment is an assignment taken after the content of the unit, or part of the unit if several assignments are used, has been delivered. An assignment may take a variety of forms, including practical and written types. An assignment is a distinct activity, completed independently by learners, that is separate from teaching, practice, exploration and other activities that learners complete with direction from teachers.

An assignment is issued to learners as an assignment brief with a defined start date, a completion date and clear requirements for the evidence that they need to provide. There may be specific observed practical components during the assignment period. Assignments can be divided into tasks and may require several forms of evidence. A valid assignment will enable a clear and formal assessment outcome, based on the assessment criteria. For most units, teachers will set the assignments. For Pearson Set Assignment units, Pearson will set the assignment.

Assessment decisions through applying unit-based criteria

Assessment decisions for BTEC International Level 3 qualifications are based on the specific criteria given in each unit and set at each grade level. To ensure that standards are consistent in the qualification and across the suite as a whole, the criteria for each unit have been defined according to a framework. The way in which individual units are written provides a balance of assessment of understanding, practical skills and vocational attributes appropriate to the purpose of qualifications.

The assessment criteria for a unit are hierarchical and holistic. For example, if an M criterion requires the learner to show 'analysis' and the related P criterion requires the learner to 'explain', then to satisfy the M criterion, a learner will need to cover both 'explain' and 'analyse'. The unit assessment grid shows the relationships between the criteria so that assessors can apply all the criteria to the learner's evidence at the same time. In *Appendix 3: Glossary of terms used*, we have set out a definition of terms that assessors need to understand.

Assessors must show how they have reached their decisions using the criteria in the assessment records. When a learner has completed all the assessment for a unit, then the assessment team will give a grade for the unit. This is given according to the highest level for which the learner is judged to have met all the criteria. Therefore:

- to achieve a Distinction, a learner must have satisfied all the Distinction criteria (and therefore the Pass and Merit criteria); these define outstanding performance across the unit as a whole
- to achieve a Merit, a learner must have satisfied all the Merit criteria (and therefore the Pass criteria) through high performance in each learning aim
- to achieve a Pass, a learner must have satisfied all the Pass criteria for the learning aims, showing coverage of the unit content and therefore attainment at Level 3 of the qualification.

The award of a Pass is a defined level of performance and cannot be given solely on the basis of a learner completing assignments. Learners who do not satisfy the Pass criteria should be reported as Unclassified.

The assessment team

It is important that there is an effective team for internal assessment. There are three key roles involved in implementing assessment processes in your centre, each with different interrelated responsibilities; the roles are listed below. There is detailed information in the *BTEC International Quality Assurance Handbook*.

- The Lead Internal Verifier (the Lead IV) has overall responsibility for the programme, its assessment and internal verification, record keeping and liaison with the Standards Verifier, ensuring our requirements are met. The Lead IV registers with Pearson annually. The Lead IV acts as an assessor, standardises and supports the rest of the assessment team, making sure that they have the information they need about our assessment requirements and organises training, making use of our standardisation, guidance and support materials.
- Internal Verifiers (IVs) oversee all assessment activities in consultation with the Lead IV. They check that assignments and assessment decisions are valid and that they meet our requirements. IVs will be standardised by working with the Lead IV. Normally, IVs are also assessors but they do not verify their own assessments.
- Assessors set or use assignments to assess learners. Before making any assessment decisions, assessors participate in standardisation activities led by the Lead IV. They work with the Lead IV and IVs to ensure that the assessment is planned and carried out in line with our requirements.

Effective organisation

Internal assessment needs to be well organised so that the progress of learners can be tracked and so that we can monitor that assessment is being carried out. We support you through, for example, providing training materials and sample documentation. Our online Pearson Progress service can help support you in planning and record keeping. Further information on using Pearson Progress can be found in *Section 10 Resources and support*, and on our website.

It is particularly important that you manage the overall assignment programme and deadlines to make sure that learners are able to complete assignments on time.

Learner preparation

To ensure that you provide effective assessment for your learners, you need to make sure that they understand their responsibilities for assessment and the centre's arrangements.

From induction onwards, you will want to ensure that learners are motivated to work consistently and independently to achieve the requirements of the qualifications. Learners need to understand how assignments are used, the importance of meeting assignment deadlines and that all the work submitted for assessment must be their own.

You will need to give learners a guide that explains how assignments are used for assessment, how assignments relate to the teaching programme and how learners should use and reference source materials, including what would constitute plagiarism. The guide should also set out your approach to operating assessment, such as how learners must submit work and request extensions.

Making valid assessment decisions

Authenticity of learner work

Once an assessment has begun, learners must not be given feedback on progress towards fulfilling the targeted criteria.

An assessor must assess only learner work that is authentic, i.e. learners' own independent work. Learners must authenticate the evidence that they provide for assessment through signing a declaration stating that it is their own work.

Assessors must ensure that evidence is authentic to a learner through setting valid assignments and supervising them during the assessment period. Assessors must take care not to provide direct input, instructions or specific feedback that may compromise authenticity.

Assessors must complete a declaration that:

- to the best of their knowledge the evidence submitted for this assignment is the learner's own
- the learner has clearly referenced any sources used in the work
- they understand that false declaration is a form of malpractice.

Centres can use Pearson templates or their own templates to document authentication.

During assessment, an assessor may suspect that some or all of the evidence from a learner is not authentic. The assessor must then take appropriate action using the centre's policies for malpractice. Further information is given in *Section 7 Administrative arrangements*.

Making assessment decisions using criteria

Assessors make judgements using the criteria. The evidence from a learner can be judged using all the relevant criteria at the same time. The assessor needs to make a judgement against each criterion that evidence is present and sufficiently comprehensive. For example, the inclusion of a concluding section may be insufficient to satisfy a criterion requiring 'evaluation'.

Assessors should use the following information and support in reaching assessment decisions:

- the *Essential information for assessment decisions* section in each unit gives examples and definitions related to terms used in the criteria
- the explanation of key terms in *Appendix 3: Glossary of terms used*
- examples of assessed work provided by Pearson
- your Lead IV and assessment team's collective experience, supported by the standardisation materials we provide.

Pass and Merit criteria relate to individual learning aims. The Distinction criteria as a whole relate to outstanding evidence across the unit. Therefore, criteria may relate to more than one learning aim (for example A.D1) or to several learning aims (for example DE.D3). Distinction criteria make sure that learners have shown that they can perform consistently at an outstanding level across the unit and/or that they are able to draw learning together across learning aims.

Issuing assessment decisions and feedback

Once the assessment team has completed the assessment process for an assignment, the outcome is a formal assessment decision. This is recorded formally and reported to learners.

The information given to the learner:

- must show the formal decision and how it has been reached, indicating how or where criteria have been met
- may show why attainment against criteria has not been demonstrated
- must not provide feedback on how to improve evidence
- must be validated by an IV before it is given to the learner.

Planning and record keeping

For internal processes to be effective, an assessment team needs to be well organised and keep effective records. The centre will work closely with us so that we can ensure that standards are being satisfied and achieved. This process gives stakeholders confidence in the assessment approach.

The programme must have an assessment plan validated by the Lead IV, produced as a spreadsheet. When producing a plan, the assessment team needs to consider:

- the time required for training and standardisation of the assessment team
- the time available to undertake teaching and carry out assessment, taking account of when learners may complete assessments and when quality assurance will take place
- the completion dates for different assignments and the name of each Assessor
- who is acting as the Internal Verifier for each assignment and the date by which the assignment needs to be internally verified

- setting an approach to sampling assessor decisions though internal verification that covers all assignments, assessors and a range of assessment decisions
- how to manage the assessment and verification of learners' work so that they can be given formal decisions promptly
- how resubmission opportunities can be scheduled.

The Lead IV will also maintain records of assessment undertaken. The key records are:

- internal verification of assignment briefs
- learner authentication declarations
- assessor decisions on assignments, with feedback given to learners
- internal verification of assessment decisions
- assessment tracking for the unit.

There are examples of records and further information in the *BTEC International Quality Assurance Handbook*.

Setting effective assignments (applies to all units without Pearson Set Assignments)

Setting the number and structure of assignments

This section does not apply to Pearson Set Assignment units. In setting your assignments, you need to work with the structure of assignments shown in the *Essential information for assignments* section of a unit. This shows the structure of the learning aims and criteria that you must follow and the recommended number of assignments that you should use. For these units we provide sample Authorised Assignment Briefs and we give you suggestions on how to create suitable assignments. You can find these materials on
our website. In designing your own assignment briefs, you should bear in mind the following points.

- The number of assignments for a unit must not exceed the number shown in *Essential information for assignments*. However, you may choose to combine assignments, for example to create a single assignment for the whole unit.
- You may also choose to combine all or parts of different units into single assignments, provided that all units and all their associated learning aims are fully addressed in the programme overall. If you choose to take this approach, you need to make sure that learners are fully prepared so that they can provide all the required evidence for assessment and that you are able to track achievement in the records.
- A learning aim must always be assessed as a whole and must not be split into two or more assignments.
- The assignment must be targeted to the learning aims but the learning aims and their associated criteria are not tasks in themselves. Criteria are expressed in terms of the outcome shown in the evidence.
- For units containing synoptic assessment, the planned assignments must allow learners to select and apply their learning, using appropriate self-management of tasks.
- You do not have to follow the order of the learning aims of a unit in setting assignments but later learning aims often require learners to apply the content of earlier learning aims and they may require learners to draw their learning together.

- Assignments must be structured to allow learners to demonstrate the full range of achievement at all grade levels. Learners need to be treated fairly by being given the opportunity to achieve a higher grade if they have the ability.
- As assignments provide a final assessment, they will draw on the specified range of teaching content for the learning aims. The specified content is compulsory. The evidence for assessment need not cover every aspect of the teaching content as learners will normally be given particular examples, case studies or contexts in their assignments. For example, if a learner is carrying out one practical performance, or an investigation of one organisation, then they will address all the relevant range of content that applies in that instance.

Providing an assignment brief

A good assignment brief is one that, through providing challenging and realistic tasks, motivates learners to provide appropriate evidence of what they have learned.

An assignment brief should have:

- a vocational scenario, this could be a simple situation or a full, detailed set of vocational requirements that motivates the learner to apply their learning through the assignment
- clear instructions to the learner about what they are required to do, normally set out through a series of tasks
- an audience or purpose for which the evidence is being provided
- an explanation of how the assignment relates to the unit(s) being assessed.

Forms of evidence

BTECs have always allowed for a variety of forms of evidence to be used – provided that they are suited to the type of learning aim being assessed. For many units, the practical demonstration of skills is necessary and, for others, learners will need to carry out their own research and analysis. The units give you information on what would be suitable forms of evidence to give learners the opportunity to apply a range of employability or transferable skills. Centres may choose to use different suitable forms of evidence to those proposed. Overall, learners should be assessed using varied forms of evidence.

Full definitions of types of assessment are given in *Appendix 3: Glossary of terms used*. These are some of the main types of assessment:

- written reports
- projects
- time-constrained practical assessments with observation records and supporting evidence
- recordings of performance
- sketchbooks, working logbooks, reflective journals
- presentations with assessor questioning.

The form(s) of evidence selected must:

- allow the learner to provide all the evidence required for the learning aim(s) and the associated assessment criteria at all grade levels
- allow the learner to produce evidence that is their own independent work
- allow a verifier to independently reassess the learner to check the assessor's decisions.

For example, when you are using performance evidence, you need to think about how supporting evidence can be captured through recordings, photographs or task sheets.

Centres need to take particular care that learners are enabled to produce independent work. For example, if learners are asked to use real examples, then best practice would be to encourage them to use their own or to give the group a number of examples that can be used in varied combinations.

Late completion, resubmission and retakes (applies to all units including Pearson Set Assignment units)

Dealing with late completion of assignments for internally-assessed units

Learners must have a clear understanding of the centre policy on completing assignments by the deadlines that you give them. Learners may be given authorised extensions for legitimate reasons, such as illness at the time of submission, in line with your centre policies.

For assessment to be fair, it is important that learners are all assessed in the same way and that some learners are not advantaged by having additional time or the opportunity to learn from others. Therefore, learners who do not complete assignments by your planned deadline or by the authorised extension deadline may not have the opportunity to subsequently resubmit.

If you accept a late completion by a learner, then the assignment should be assessed normally when it is submitted, using the relevant assessment criteria.

Resubmission of improved evidence for internally-assessed units

An assignment provides the final assessment for the relevant learning aims and is normally a final assessment decision, except where the Lead IV approves one opportunity to resubmit improved evidence based on the completed assignment brief.

The Lead IV has the responsibility to make sure that resubmission is operated fairly. This means:

- checking that a learner can be reasonably expected to perform better through a second submission, for example that the learner has not performed as expected
- making sure that giving a further opportunity can be done in such a way that it does not give an unfair advantage over other learners, for example through the opportunity to take account of feedback given to other learners
- checking that the assessor considers that the learner will be able to provide improved evidence without further guidance and that the original evidence submitted has been authenticated by both the learner and assessor and remains valid.

Once an assessment decision has been given to the learner, the resubmission opportunity must have a deadline within 15 working days after the timely issue of assessment feedback to learners, which is within term time in the same academic year.

A resubmission opportunity must not be provided where learners:

- have not completed the assignment by the deadline without the centre's agreement
- have submitted work that is not authentic.

We recognise that there are circumstances where the resubmission period may fall outside of the 15-day limit owing to a lack of resources being available, for example where learners may need to access a performance space or have access to specialist equipment. Where it is practical to do so, for example evaluations, presentations, extended writing, resubmission must remain within the normal 15-day period.

Retake of internal assessment

A learner who has not achieved the level of performance required to pass the relevant learning aims after resubmission of an assignment may be offered a single retake opportunity using a new assignment. The retake may be achieved at a Pass only.

The Lead Internal Verifier must authorise a retake of an assignment only in exceptional circumstances where they believe it is necessary, appropriate and fair to do so. The retake is not time bound and the assignment can be attempted by the learner on a date agreed between the Lead IV and assessor within the same academic year.

For further information on offering a retake opportunity, you should refer to the *BTEC Centre Guide to Internal Assessment*. Information on writing assignments for retakes is given on our website (www.btec.co.uk/keydocuments).

7 Administrative arrangements

Introduction

This section focuses on the administrative requirements for delivering a BTEC qualification. It is of particular value to Quality Nominees, Lead IVs, Programme Leaders and Examinations Officers.

Learner registration and entry

Shortly after learners start the programme of learning, you need to make sure that they are registered for the qualification and that appropriate arrangements are made for internal assessment. You need to refer to the relevant section for BTEC International in the *Information Manual* for information on making registrations for the qualification.

Learners can be formally assessed only for a qualification on which they are registered. If learners' intended qualifications change, for example if a learner decides to choose a different pathway specialism, then the centre must transfer the learner appropriately.

Access to assessment

Assessments need to be administered carefully to ensure that all learners are treated fairly, and that results and certification are issued on time to allow learners to progress to their chosen progression opportunities.

Our equality policy requires that all learners should have equal opportunity to access our qualifications and assessments, and that our qualifications are awarded in a way that is fair to every learner. We are committed to making sure that:

- learners with a protected characteristic are not, when they are undertaking one of our qualifications, disadvantaged in comparison to learners who do not share that characteristic
- all learners achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Further information on access arrangements can be found in the document Supplementary guidance for reasonable adjustments and special consideration.

Administrative arrangements for assessment

Records

You are required to retain records of assessment for each learner. Records should include assessments taken, decisions reached and any adjustments or appeals. Further information can be found in the relevant section for BTEC International in the *Information Manual*. We may ask to audit your records, so they must be retained as specified.

Reasonable adjustments to assessment

To ensure that learners have fair access to demonstrate the requirements of the assessments, a reasonable adjustment is one that is made before a learner takes an assessment. You are able to make adjustments to internal assessments to take account of the needs of individual learners. In most cases, this can be achieved through a defined time extension or by adjusting the format of evidence. We can advise you if you are uncertain as to whether an adjustment is fair and reasonable. You need to plan for time to make adjustments if necessary.

Further details on how to make adjustments for learners with protected characteristics are given on our website, in the document *Supplementary guidance for reasonable adjustments and special consideration*.

Special consideration

Special consideration is given after an assessment has taken place for learners who have been affected by adverse circumstances, such as illness. You must operate special consideration in line with our policy (see above). You can give special consideration related to the period of time given for evidence to be provided or for the format of the assessment if it is equally valid. You may not substitute alternative forms of evidence to that required in a unit or omit the application of any assessment criteria to judge attainment. Pearson can consider applications for special consideration if they are in line with the policy.

Appeals against assessment

Your centre must have a policy for dealing with appeals from learners. These appeals may relate to assessment decisions being incorrect or assessment not being conducted fairly. The first step in such a policy could be a consideration of the evidence by a Lead IV or other member of the programme team. The assessment plan should allow time for potential appeals after assessment decisions have been given to learners. If there is an appeal by a learner, you must document the appeal and its resolution. Learners have a final right of appeal to Pearson but only if the procedures that you have put in place have not been followed. Further details are given in the document *Internal assessment in vocational qualifications: reviews and appeals policy*.

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Conducting set assignments

Centres must make arrangements for the secure delivery of Pearson Set Assignments.

At least one Pearson Set Assignment will be available each year for each unit with an additional one provided for resit. Centres must not select an assignment that learners have attempted already.

Each set assignment has a defined degree of control under which it must take place. We define degrees of control as follows.

Medium control

This is completion of assessment, usually over a longer period of time, which may include a period of controlled conditions. The controlled conditions may allow learners to access resources, prepared notes or the internet to help them complete the assignment.

Low control

These are activities completed without direct supervision. They may include research, preparation of materials and practice.

Each set assignment unit will contain instructions in the *Essential information for assignments* section on how to conduct the assessment of that unit.

Some set assignments will need to be taken with limited controls. Limited controls are described in each unit and may include the following conditions:

- Time: each assignment has a recommended time period. This is for advice only and can be adjusted depending on the needs of learners.
- Supervision: you should be confident of the authenticity of learner's work. This may mean that learners be supervised.
- Resources: all learners should have access to the same types of resources to complete the assignment.
- Research: learners should be given the opportunity to carry out research outside of the learning context if required for the assignment.

Schools and colleges must be able to confirm that learner evidence is authentic.

Dealing with malpractice in assessment

Malpractice means acts that undermine the integrity and validity of assessment, the certification of qualifications, and/or that may damage the authority of those responsible for delivering the assessment and certification.

Pearson does not tolerate actions (or attempted actions) of malpractice by learners, centre staff or centres in connection with Pearson qualifications. Pearson may impose penalties and/or sanctions on learners, centre staff or centres where incidents (or attempted incidents) of malpractice have been proven.

Malpractice may arise or be suspected in relation to any unit or type of assessment within the qualification. For further details regarding malpractice and advice on preventing malpractice by learners, please see Pearson's *Centre guidance: Dealing with malpractice and maladministration in vocational qualifications*, available on our website.

Centres are required to take steps to prevent malpractice and to investigate instances of suspected malpractice. Learners must be given information that explains what malpractice is for internal assessment and how suspected incidents will be dealt with by the centre. The *Centre Guidance: Dealing with malpractice and maladministration in vocational qualifications* document gives comprehensive information on the actions we expect you to take.

Pearson may conduct investigations if we believe that a centre is failing to conduct internal assessment according to our policies. The above document gives further information and examples, and details the penalties and sanctions that may be imposed.

In the interests of learners and centre staff, centres need to respond effectively and openly to all requests relating to an investigation into an incident of suspected malpractice.

Learner malpractice

Learner malpractice refers to any act by a learner that compromises or which seeks to compromise the process of assessment or which undermines the integrity of the qualifications or the validity of results/certificates.

Learner malpractice in examinations **must** be reported to Pearson using a *JCQ Form M1* (available at www.jcq.org.uk/exams-office/malpractice). The form should be emailed to candidatemalpractice@pearson.com. Please provide as much information and supporting documentation as possible. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice constitutes staff or centre malpractice.

Staff/centre malpractice

Staff and centre malpractice includes both deliberate malpractice and maladministration of our qualifications. As with learner malpractice, staff and centre malpractice is any act that compromises or which seeks to compromise the process of assessment, or which undermines the integrity of the qualifications or the validity of results/certificates.

All cases of suspected staff malpractice and maladministration **must** be reported immediately, before any investigation is undertaken by the centre, to Pearson on a *JCQ Form M2* (available at www.jcq.org.uk/exams-office/malpractice).

The form, supporting documentation and as much information as possible should be emailed to pqsmalpractice@pearson.com. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice itself constitutes malpractice.

More detailed guidance on malpractice can be found in the latest version of the document *JCQ Suspected Malpractice Policies and Procedures*, available at www.jcq.org.uk/exams-office/malpractice.

Sanctions and appeals

Where malpractice is proven, we may impose sanctions or penalties.

Where learner malpractice is evidenced, penalties may be imposed such as:

- disqualification from the qualification
- being barred from registration for Pearson qualifications for a period of time.

If we are concerned about your centre's quality procedures, we may impose sanctions, such as:

- working with you to create an improvement action plan
- requiring staff members to receive further training
- placing temporary blocks on your certificates
- placing temporary blocks on registration of learners
- debarring staff members or the centre from delivering Pearson qualifications
- suspending or withdrawing centre approval status.

The centre will be notified if any of these apply.

Pearson has established procedures for centres that are considering appeals against penalties and sanctions arising from malpractice. Appeals against a decision made by Pearson will normally be accepted only from Heads of Centres (on behalf of learners and/or members of staff) and from individual members (in respect of a decision taken against them personally). Further information on appeals can be found in our document *Internal assessment in vocational qualifications: reviews and appeals policy*, which is on our website. In the initial stage of any aspect of malpractice, please notify the Investigations Team by email via pqsmalpractice@pearson.com, who will inform you of the next steps.

Certification and results

Once a learner has completed all the required components for a qualification, the centre can claim certification for the learner, provided that quality assurance has been successfully completed. For the relevant procedures, please refer to the BTEC International section of our *Information Manual*. You can use the information provided on qualification grading to check overall qualification grades.

Changes to qualification requests

Where a learner who has taken a qualification wants to resit a unit to improve their qualification grade, you firstly need to decline their overall qualification grade. You may decline the grade before the certificate is issued.

Additional documents to support centre administration

As an approved centre, you must ensure that all staff delivering, assessing and administering the qualifications have access to the following documentation. These documents are reviewed annually and are reissued if updates are required.

- *BTEC International Quality Assurance Handbook*: this sets out how we will carry out quality assurance of standards and how you need to work with us to achieve successful outcomes.
- *International Information Manual*: this gives procedures for registering learners for qualifications, transferring registrations and claiming certificates.
- *Regulatory policies*: our regulatory policies are integral to our approach and explain how we meet internal and regulatory requirements. We review the regulated policies annually to ensure that they remain fit for purpose. Policies related to this qualification include:
    - adjustments for candidates with disabilities and learning difficulties, access arrangements and reasonable adjustments for learners of determination for general and vocational qualifications
    - age of learners
    - centre guidance for dealing with malpractice
    - recognition of prior learning and process.

This list is not exhaustive and a full list of our regulatory policies can be found on our website.

8 Quality assurance

Centre and qualification approval

As part of the approval process, your centre must make sure that the resource requirements listed below are in place before offering the qualification.

- Centres must have appropriate physical resources (for example equipment, IT, learning materials, teaching rooms) to support the delivery and assessment of the qualification.
- Staff involved in the assessment process must have relevant expertise and/or occupational experience.
- There must be systems in place to ensure continuing professional development for staff delivering the qualification.
- Centres must have in place appropriate health and safety policies relating to the use of equipment by learners.
- Centres must deliver the qualification in accordance with current equality and diversity legislation and/or regulations.
- Centres should refer to the *Further information for teachers and assessors* section in individual units to check for any specific resources required.

Continuing quality assurance and standards verification

On an annual basis, we produce the *BTEC International Quality Assurance Handbook*. It contains detailed guidance on the quality processes required to underpin robust assessment and internal verification.

The key principles of quality assurance are that:

- a centre delivering BTEC programmes must be an approved centre, and must have approval for the programmes or groups of programmes that it is delivering
- the centre agrees, as part of gaining approval, to abide by specific terms and conditions around the effective delivery and quality assurance of assessment; the centre must abide by these conditions throughout the period of delivery
- Pearson makes available to approved centres resources and processes that exemplify assessment and appropriate standards. Approved centres must use these to ensure that all staff delivering BTEC qualifications keep up to date with the guidance on assessment
- an approved centre must follow agreed protocols for standardisation of assessors and verifiers, for the planning, monitoring and recording of assessment processes, and for dealing with special circumstances, appeals and malpractice.

The approach of quality-assured assessment is through a partnership between an approved centre and Pearson. We will make sure that each centre follows best practice and employs appropriate technology to support quality-assurance processes, where practicable. We work to support centres and seek to make sure that our quality-assurance processes do not place undue bureaucratic processes on centres. We monitor and support centres in the effective operation of assessment and quality assurance.

The methods we use to do this for BTEC Level 3 include:

- making sure that all centres complete appropriate declarations at the time of approval
- undertaking approval visits to centres
- making sure that centres have effective teams of assessors and verifiers who are trained to undertake assessment
- assessment sampling and verification, through requested samples of assessments, completed assessed learner work and associated documentation
- an overarching review and assessment of a centre's strategy for delivering and quality assuring its BTEC programmes, for example making sure that synoptic units are placed appropriately in the order of delivery of the programme.

Centres that do not fully address and maintain rigorous approaches to delivering, assessing and quality assurance cannot seek certification for individual programmes or for all BTEC Level 3 programmes. An approved centre must make certification claims only when authorised by us and strictly in accordance with requirements for reporting.

Centres that do not comply with remedial action plans may have their approval to deliver qualifications removed.

9 Understanding the qualification grade

Awarding and reporting for the qualification

This section explains the rules that we apply in awarding a qualification and in providing an overall qualification grade for each learner. It shows how all the qualifications in this sector are graded.

Eligibility for an award

In order to be awarded a qualification, a learner must complete all units AND achieve a Pass or above in all mandatory units unless otherwise specified. Refer to the structure in *Section 2 Structure*.

To achieve any qualification grade, learners must:

- complete and have an outcome (D, M, P or U) for all units within a valid combination
- achieve the **required units at Pass or above** shown in *Section 2*, abiding by the minimum requirements in the compensation table below
- achieve the **minimum number of points** at a grade threshold.

It is the responsibility of a centre to ensure that a correct unit combination is adhered to. Learners who do not achieve the required minimum grade (P) in units shown in the structure will not achieve a qualification.

Learners who do not achieve sufficient points for a qualification or who do not achieve all the required units may be eligible to achieve a smaller qualification in the same suite, provided they have completed and achieved the correct combination of units and met the appropriate qualification grade points threshold.

Compensation table

Qualification	Compensation rule	Unit equivalence
Certificate (180 GLH)	No compensation allowed	0 units
Subsidiary Diploma (360 GLH)	Mandatory must be passed, 60 GLH only at U grade permitted from optional	1 * 60 GLH unit
Foundation Diploma (540 GLH)	Mandatory must be passed, 120 GLH only at U grade permitted from optional	e.g. 2 * 60 GLH units OR 1 * 120 GLH unit
Diploma (720 GLH)	Mandatory must be passed, 180 GLH only at U grade permitted from optional	e.g. 3 * 60 GLH units OR 1 * 60 GLH and 1 * 120 GLH unit
Extended Diploma (1080 GLH)	Mandatory must be passed, 180 GLH only at U grade permitted from optional	e.g. 3 * 60 GLH units OR 1 * 60 GLH and 1 * 120 GLH unit

Calculation of the qualification grade

The final grade awarded for a qualification represents an aggregation of a learner's performance across the qualification. As the qualification grade is an aggregate of the total performance, there is some element of compensation in that a higher performance in some units may be balanced by a lower outcome in others.

In the event that a learner achieves more than the required number of optional units, the mandatory units, along with the optional units with the highest grades, will be used to calculate the overall result, subject to the eligibility requirements for that particular qualification title.

BTEC International Level 3 qualifications are awarded at the grade ranges shown in the table below.

Qualification	Available grade range
Certificate, Subsidiary Diploma, Foundation Diploma	P to D*
Diploma	PP to D*D*
Extended Diploma	PPP to D*D*D*

The *Calculation of qualification grade* table, given later in this section, shows the minimum thresholds for calculating these grades. The table will be kept under review over the lifetime of the qualification. In the event of any change, centres will be informed before the start of teaching for the relevant cohort and an updated table will be issued on our website.

Learners who do not meet the minimum requirements for a qualification grade to be awarded will be recorded as Unclassified (U) and will not be certificated. They may receive a Notification of Performance for individual units. The *Information Manual* gives full information.

Points available for unit Size and grades

The table below shows the number of **points** available for internal units. For each internal unit, points are allocated depending on the grade awarded.

	Unit size	
	60 GLH	120GLH
U	0	0
Pass	6	12
Merit	10	20
Distinction	16	32

Claiming the qualification grade

Pearson will automatically calculate the qualification grade for your learners when the unit grades are submitted and the qualification claim is made. Learners will be awarded qualification grades for achieving the sufficient number of points within the ranges shown in the relevant *Calculation of qualification grade* table.

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Calculation of qualification grade

Applicable for registration from 1 April 2020.

Certificate		Subsidiary Diploma		Foundation Diploma		Diploma		Extended Diploma	
180 GLH		360 GLH		540 GLH		720 GLH		1080 GLH	
Grade	Points threshold	Grade	Points threshold	Grade	Points threshold	Grade	Points threshold	Grade	Points threshold
Unclassified	0	U	0	U	0	U	0	U	0
Pass	18	P	36	P	54	PP	72	PPP	108
						MP	88	MPP	124
								MMP	140
Merit	26	M	52	M	78	MM	104	MMM	156
						DM	124	DMM	176
								DDM	196
Distinction	42	D	74	D	108	DD	144	DDD	216
						D*D	162	D*DD	234
								D*D*D	252
Distinction*	48	D*	90	D*	138	D*D*	180	D*D*D*	270

This table is subject to review over the lifetime of the qualification. The most up-to-date version will be issued via our website.

Examples of grade calculations based on table applicable to registrations from April 2020

Example 1: Achievement of a Certificate with a P grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Pass	6
Unit 2	60	Int	Merit	10
Unit 10	60	Int	Pass	6
Totals	**180**		**P**	**22**

The learner has sufficient points for a P grade.

Example 2: Achievement of a Certificate with an M grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Pass	6
Unit 2	60	Int	Distinction	16
Unit 6	60	Int	Pass	6
Totals	**180**		**M**	**28**

The learner has sufficient points for an M grade.

Example 3: An Unclassified result for a Certificate

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Unclassified	0
Unit 2	60	Int	Distinction	16
Unit 6	60	Int	Pass	6
Totals	**180**		**Unclassified**	**22**

The learner has an Unclassified result in Unit 1.

The learner has sufficient points for a P grade but has not met the minimum requirement for a grade in Unit 1.

Examples of grade calculations based on table applicable to registrations from April 2020

Example 1: Achievement of a Subsidiary Diploma with a P grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Distinction	16
Unit 2	60	Int	Merit	10
Unit 3	60	PSA	Merit	10
Unit 4	60	Int	Unclassified	0
Totals	**360**		**P**	**36**

The learner has achieved P or higher in Units 1, 2 and 3.

The learner has sufficient points for a P grade.

Example 2: Achievement of a Subsidiary Diploma with an M grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Pass	6
Unit 2	60	Int	Merit	10
Unit 3	60	PSA	Distinction	16
Unit 4	60	PSA	Distinction	16
Unit 6	60	PSA	Merit	10
Unit 10	60	Int	Merit	10
Totals	**360**		**M**	**68**

The learner has sufficient points for an M grade.

Example 3: An Unclassified Result for a Subsidiary Diploma

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Unclassified	0
Unit 2	60	Int	Merit	10
Unit 3	60	PSA	Distinction	16
Unit 4	60	PSA	Distinction	16
Unit 6	60	PSA	Unclassified	0
Unit 18	60	Int	Merit	10
Totals	**360**		**Unclassified**	**52**

The learner has a U in Unit 1.

The learner has sufficient points for an M grade but has not met the minimum requirement for a P or higher in Units 1 and 6.

Examples of grade calculations based on table applicable to registrations from April 2020

Example 1: Achievement of a Foundation Diploma with a P grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Merit	10
Unit 2	60	Int	Pass	6
Unit 3	60	PSA	Merit	10
Unit 4	60	PSA	Pass	6
Unit 6	60	PSA	Pass	6
Unit 8	60	Int	Merit	10
Unit 12	60	Int	Unclassified	0
Unit 17	60	Int	Pass	6
Unit 18	60	Int	Pass	6
Totals	**540**		**P**	**60**

The learner has sufficient points for a P grade.

Example 2: Achievement of a Foundation Diploma with an M grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Merit	10
Unit 2	60	Int	Pass	6
Unit 3	60	PSA	Distinction	16
Unit 4	60	PSA	Pass	6
Unit 6	60	PSA	Pass	6
Unit 8	60	Int	Merit	10
Unit 12	60	Int	Distinction	16
Unit 17	60	Int	Pass	6
Unit 18	60	Int	Pass	6
Totals	**540**		**M**	**82**

The learner has sufficient points for an M grade.

Example 3: An Unclassified result for a Foundation Diploma

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Merit	10
Unit 2	60	Int	Pass	6
Unit 3	60	PSA	Unclassified	0
Unit 4	60	PSA	Pass	6
Unit 6	60	PSA	Merit	10
Unit 8	60	Int	Merit	10
Unit 12	60	Int	Distinction	16
Unit 17	60	Int	Pass	6
Unit 18	60	Int	Distinction	16
Totals	**540**		**Unclassified**	**80**

The learner has an Unclassified result in Unit 3.

The learner has sufficient points for an M grade but has not met the minimum requirement for P or higher in Unit 3.

Examples of grade calculations based on table applicable to registrations from April 2020

Example 1: Achievement of a Diploma with a PP grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Pass	6
Unit 2	60	Int	Pass	6
Unit 3	60	PSA	Pass	6
Unit 4	60	PSA	Pass	6
Unit 5	60	PSA	Merit	10
Unit 6	60	PSA	Merit	10
Unit 8	60	Int	Merit	10
Unit 12	60	Int	Merit	10
Unit 17	60	Int	Unclassified	0
Unit 21	60	Int	Pass	6
Unit 22	60	Int	Pass	6
Unit 23	60	Int	Pass	6
Totals	**720**		**PP**	**82**

The learner has achieved P or higher in Units 1 to 12.

The learner has sufficient points for a PP grade.

Example 2: An Unclassified result for a Diploma

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Merit	10
Unit 2	60	Int	Unclassified	0
Unit 3	60	PSA	Unclassified	0
Unit 4	60	PSA	Merit	10
Unit 5	60	PSA	Pass	6
Unit 6	60	PSA	Pass	6
Unit 8	60	Int	Pass	6
Unit 12	60	Int	Merit	10
Unit 17	60	Int	Unclassified	0
Unit 21	60	Int	Distinction	16
Unit 22	60	Int	Pass	6
Unit 23	60	Int	Pass	6
Totals	**720**		**Unclassified**	**76**

The learner has Unclassified results in Units 2 and 3.

Examples of grade calculations based on table applicable to registrations from April 2020

Example 1: Achievement of an Extended Diploma with a PPP grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Pass	6
Unit 2	60	Int	Pass	6
Unit 3	60	PSA	Pass	6
Unit 4	60	PSA	Pass	6
Unit 5	60	PSA	Merit	10
Unit 6	60	PSA	Merit	10
Unit 7	120	Int	Merit	20
Unit 8	60	Int	Distinction	16
Unit 9	60	Int	Pass	6
Unit 10	60	Int	Merit	10
Unit 11	60	Int	Pass	6
Unit 12	60	Int	Pass	6
Unit 13	60	Int	Pass	6
Totals	**1080**		**PPP**	**114**

The learner has achieved P or higher in Units 1 to 13.

The learner has sufficient points for a PPP grade.

Example 2: Achievement of an Extended Diploma with a DDM grade

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Pass	6
Unit 2	60	Int	Merit	10
Unit 3	60	PSA	Distinction	32
Unit 4	60	PSA	Merit	20
Unit 5	60	PSA	Distinction	24
Unit 6	60	PSA	Distinction	24
Unit 7	120	Int	Merit	20
Unit 8	60	Int	Distinction	16
Unit 9	60	Int	Distinction	16
Unit 10	60	Int	Merit	10
Unit 11	60	Int	Merit	10
Unit 12	60	Int	Distinction	16
Unit 13	60	Int	Pass	6
Totals	**1080**		**DDM**	**210**

The learner has sufficient points for a DDM grade.

Example 3: An Unclassified result for an Extended Diploma

	GLH	Type (Int/PSA)	Grade	Unit points
Unit 1	60	PSA	Pass	6
Unit 2	60	Int	Merit	10
Unit 3	60	PSA	Distinction	32
Unit 4	60	PSA	Merit	20
Unit 5	60	PSA	Distinction	24
Unit 6	60	PSA	Distinction	24
Unit 7	90	Int	Distinction	24
Unit 8	60	Int	Merit	10
Unit 9	60	Int	Unclassified	0
Unit 10	60	Int	Merit	10
Unit 11	60	Int	Unclassified	0
Unit 12	60	Int	Unclassified	0
Unit 13	60	Int	Unclassified	0
Totals	**1080**		**U**	**160**

The learner has 240 GLH at U.

The learner has sufficient points for an MPP and has achieved P or higher for Units 1 to 10 but has not met the minimum requirement for 900 GLH at Pass or above.

10 Resources and support

Our aim is to give you a wealth of resources and support to enable you to deliver BTEC International Level 3 qualifications with confidence. You will find a list of resources to support teaching and learning, and professional development on our website.

Support for setting up your course and preparing to teach

Specification

The specification (for teaching from April 2020) gives you details of the administration of the qualifications and information on the units for the qualifications.

Pearson Progress

Pearson Progress is a digital support system that helps you to manage the assessment and quality assurance of the Pearson BTEC International Level 3 Agriculture/Horticulture/Land-based Studies qualifications. It supports delivery, assessment and quality assurance of BTECs in centres and supports teachers and students as follows:

- course creation
- creating and verifying assignments
- creating assessment plans and recording assessment decisions
- upload of assignment evidence
- tracking progress of every learner

The system is accessible for teachers and learners so that both teachers and learners can track their progress.

Support for teaching and learning

Pearson Learning Services provide a range of engaging resources to enable you to start teaching BTEC International Level 3 qualifications. These may include the following free materials:

- delivery guides, which give you important advice on how to choose the right course for your learners and how to ensure you are fully prepared to deliver the course. They explain the key features of the BTEC International Level 3 Agriculture/Horticulture/Land-based Studies qualifications, for example employer involvement and employability skills. They also cover guidance on assessment and quality assurance.
- sample schemes of work are provided for each mandatory unit and Unit 7.
- slide presentations for use in your teaching to outline the key concepts of a unit
- delivery plans that help you structure delivery of a qualification.

We also provide paid for resources and courseware which may include:

- teacher resource packs developed by Pearson including materials and activities to fully support your teaching of units
- student study texts across a range of mandatory and optional units to support your students throughout their programme of study.

Support for assessment

Sample assessment materials for internally-assessed units

For internal units assessed with a Pearson Set Assignment we will provide a sample assignment as an example of the form of assessment for the unit. For the remaining internal units, we allow you to set your own assignments, according to your learners' preferences and to link with your local employment profile.

We provide a service in the form of Authorised Assignment Briefs and sample Pearson Set Assignments, which are approved by Pearson Standards Verifiers. They are available via our website.

Pearson English

Pearson provides a full range of support for English learning including diagnostics, qualifications and learning resources. Please see www.pearson.com/english

Training and support from Pearson

People to talk to

There are many people available to support you and give you advice and guidance on delivery of your BTEC International Level 3 qualifications. They include the following.

- Subject Advisors – available for all sectors. They understand all Pearson qualifications in their sector and can answer sector-specific queries on planning, teaching, learning and assessment.
- Standards Verifiers – they can support you with preparing your assignments, ensuring that your assessment plan is set up correctly, and support you in preparing learner work and providing quality assurance through sampling.
- Regional teams – they are regionally based and have a full overview of the BTEC qualifications and of the support and resources that Pearson provides. Regions often run network events.
- Customer Services – the 'Support for You' section of our website gives the different ways in which you can contact us for general queries. For specific queries, our service operators can direct you to the relevant person or department.

Training and professional development

Pearson provides a range of training and professional development events to support the introduction, delivery, assessment and administration of BTEC International Level 3 qualifications. These sector-specific events, developed and delivered by specialists, are available both face to face and online.

'Getting Ready to Teach'

These events are designed to get teachers ready for delivery of the BTEC International Level 3 qualifications. They include an overview of qualification structures, planning and preparation for internal assessment, and quality assurance.

Teaching and learning

Beyond the 'Getting Ready to Teach' professional development events, there are opportunities for teachers to attend sector- and role-specific events. These events are designed to connect practice to theory; they provide teacher support and networking opportunities with delivery, learning and assessment methodology.

Details of our training and professional development programme can be found on our website.

Appendix 1: Links to industry standards

BTEC International Level 3 qualifications have been developed in consultation with industry and appropriate sector bodies to ensure that content and the approach to assessment align closely to the needs of employers. Where they exist, and are appropriate, National Occupational Standards (NOS) and professional body standards have been used to establish unit content.

Appendix 2: Transferable employability skills

The need for transferable skills

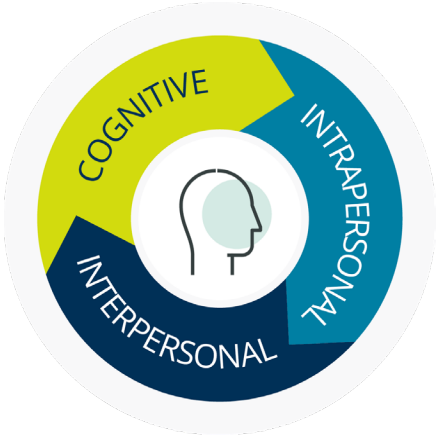
In recent years, higher-education institutions and employers have consistently flagged the need for learners to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

The Organisation for Economic Co-operation and Development (OECD) defines skills, or competencies, as 'the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to successfully and consistently perform an activity or task and can be built upon and extended through learning.' [1]

To support the design of our qualifications, the Pearson Research Team selected and evaluated seven global 21st-century skills frameworks. Following on from this process, we identified the National Research Council's (NRC) framework [2] as the most evidence-based and robust skills framework, and have used this as a basis for our adapted skills framework.

The framework includes cognitive, intrapersonal skills and interpersonal skills.

The NRC framework is included alongside literacy and numeracy skills.



The skills have been interpreted for this specification to ensure that they are appropriate for the subject. All of the skills listed are evident or accessible in the teaching, learning and/or assessment of the qualifications. Some skills are directly assessed. Pearson materials will support you in identifying these skills and in developing these skills in learners.

The table overleaf sets out the framework and gives an indication of the skills that can be found in land-based sectors, it indicates the interpretation of the skills in this area. A full interpretation of each skill, with mapping to show opportunities for learner development, is given on the subject pages of our website: http://qualifications.pearson.com.

[1] OECD – *Better Skills, Better Jobs, Better Lives* (OECD Publishing, 2012)

[2] Koenig, J. A. (2011) *Assessing 21st Century Skills: Summary of a Workshop* (National Academies Press, 2011)

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Cognitive skills	Cognitive processes and strategies	Critical thinking Problem solving Analysis Reasoning/argumentation Interpretation Decision making Adaptive learning Executive function
	Creativity	Creativity Innovation
Intrapersonal skills	Intellectual openness	Adaptability Personal and social responsibility Continuous learning Intellectual interest and curiosity
	Work ethic/ conscientiousness	Initiative Self-direction Responsibility Perseverance Productivity Self-regulation (metacognition, forethought, reflection) Ethics Integrity
	Positive core self-evaluation	Self-monitoring/ self-evaluation/ self-reinforcement
Interpersonal skills	Teamwork and collaboration	Communication Collaboration Teamwork Cooperation Empathy/perspective taking Negotiation
	Leadership	Responsibility Assertive communication Self-presentation

Developing the ability to make a persuasive case in the fields of animal husbandry or plant production and new technologies, supporting one or more arguments, including the ability to create a balanced and evaluated argument.

Taking responsibility for finding and correcting anomalies in feeding regimes.

Advocating the position of another in an oral presentation.

Appendix 3: Sustainability

Learning for a better world

As the world's leading learning company, creating a more sustainable world is a natural part of everything we do. Learning itself is the greatest force for change in our world and helping people gain knowledge and skills is, inherently, a way to improve our planet and our society. We do that everyday by turning our products into vibrant learning experiences, focusing on our people, and protecting our planet.

Our sustainable business strategy

We are aligning with the United Nation's Sustainable Development Goals that represent the environmental, social and governance areas in which we can make the biggest positive impact.

Our sustainable business strategy focuses on:

- **Products** – *driving learning for everyone with our products*
  We're widening access to learning for more people and ensuring our products have measurable outcomes.
- **People** – *empowering our people to make a difference*
  We're building a culture of belonging, along with a performance culture, so our people can make a real difference at scale.
- **Planet** – *leading responsibly for a better planet*
  We're reducing our environmental footprint and working with like-minded partners.

The United Nations' Sustainable Development Goals (SDGs) exist to achieve a better and more sustainable future for all. We contribute towards the following Sustainable Development Goals.

More detailed guidance on our sustainable business strategy and how we are contributing towards these goals, is available on our website at https://plc.pearson.com/en-GB/sustainability

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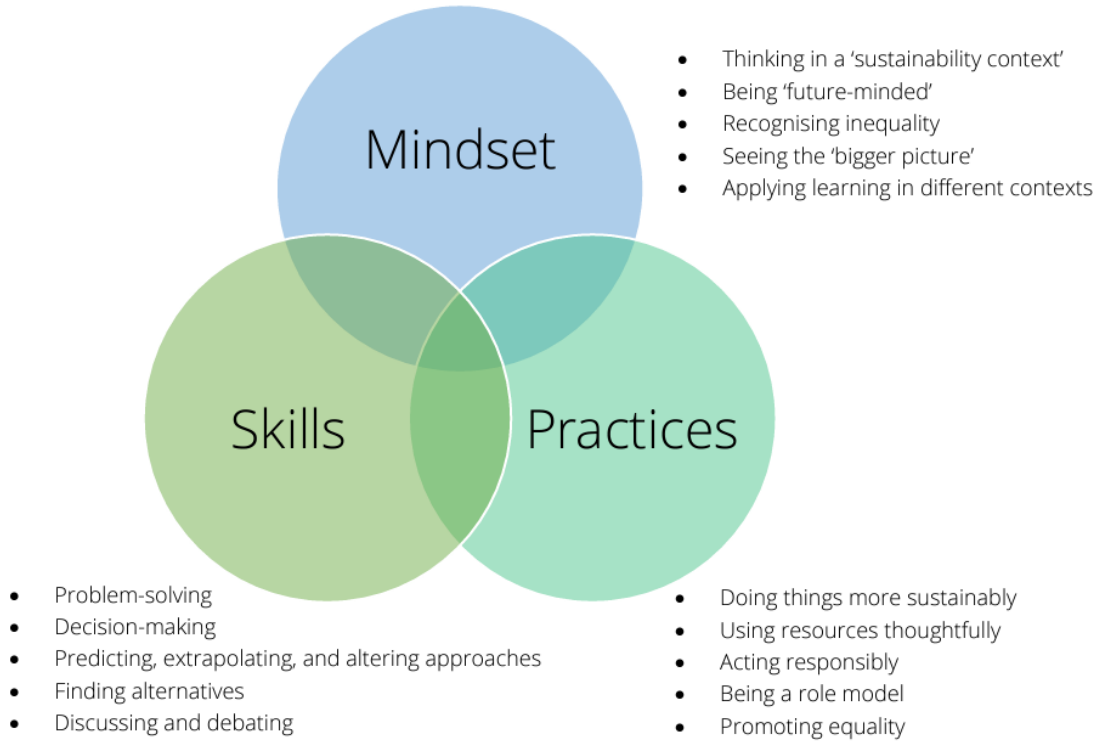
Embedding sustainability into our qualifications

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) has identified a series of cross-cutting sustainability and specialised SDG competencies, which is reflected in our qualifications.

We see sustainability in the context of our qualifications, assessments and teaching and learning resources, and how we can embed sustainability in a meaningful and pragmatic way, in three distinct areas: mindset, skills and practices.



Embedding sustainability mindset

Throughout the delivery of our BTEC Internationals, there are many opportunities to discuss sustainability topics with learners in the context of their qualification. A sustainability 'mindset' means that learners will ask the question of every topic, 'How is this sustainable?' or 'How does this affect people, the planet, and my future?'

Topics you could address in the 'sustainability mindset', are as follows:

- Energy usage
- Pollution
- Climate impact
- Human resources involved
- The global context.
- People – empowering our people to make a difference

Embedding sustainability skills

Any successful qualification teaches learners knowledge, skills and behaviours associated with a particular topic but often it is the cross-cutting skills that learners learn that end up having the most value in the long-term. Whilst we feel that a sustainable 'mindset' is vitally important to learners recognising and being able to think sustainably in the long-term, we feel that the embedding of sustainability skills is equally important because it means they will be able to 'do' something about the issue they identify through their new-found awareness of sustainability. The skills we are advocating are complementary to the skills they will develop as a matter of course on their BTEC International qualification but in this context, are given a new focus and importance.

Embedding sustainability practices

Less directly linked to the subject of a learner's study, sustainability practices are the actions and behaviours that we can encourage learners to take and develop that will enhance the sustainability of the course's delivery and their ability to make decisions and take actions that are more sustainable.

This may extend to the way they travel to school/college, the way they submit their assignment work, or the way resources are used and respected. In many ways, this is core of encouraging sustainability awareness because this is where the academic becomes practical as learners are encouraged to apply their learning in real-world ways. This aspect should complement the other key areas of sustainability covered in this section.

Our approach to sustainability in the Pearson BTEC International Level 3 in Land-based Studies, Agriculture and Horticulture

We have considered how this qualification achieves the Sustainability Development Goals (SDGs) and Cross Cutting Skills, defined by the United Nations. Whilst acknowledging that sustainability can be approached in many ways in the design, teaching and assessment of this qualification – we have embedded sustainability by exemplifying the unit content and topic areas and provided additional guidance, with examples in the assessment guidance sections of this specification, where relevant.

In addition, the following unit in the Pearson BTEC International Level 3 in Agriculture and Level 3 in Horticulture explicitly includes learning aims which highlights the importance of sustainability and the effects it has within the industry.

- Unit 47: Sustainable and Renewable Land-based Practices.

We have also further developed our assessments, and teaching and learning resources to strengthen and support the mindset, skills and practices we want your learners to embrace when they think about sustainability in the real-world.

Delivering Sustainability through Classroom Activities

Sustainability is an area that can be addressed by all vocational subjects. Teachers should consider how they can actively address sustainability as they deliver subject content and create awareness of sustainability. Examples of this could include:

- Use of sustainability related case studies to reinforce topics delivered:
  - The use of non-fossil fuel to power cars and aircraft
  - How attitudes towards the carbon footprint of food and raw materials have affected manufacturing and logistical processes
  - Sustainable travel and tourism
  - Social entrepreneurship and sustainable practices
  - Sustainable agricultural practices
  - Sustainability in art and the portrayal of visual images and artefacts
  - Repurposing of land and buildings to reduce the release of harmful materials into the environment
  - Poverty reduction and job growth
- Considering the long-term impact on the environment and climate by the organisations and vocational sectors being studied:
  - The disposable of materials and chemicals from manufacturing processes
  - The use of solar power and green energy to heat buildings and to power machinery
  - Organisational culture and adoption of sustainable business practices

More detailed guidance about our approach, with examples of how you can embed sustainability into the qualifications you deliver, is available on our qualifications website.

Appendix 4: Glossary of terms used

This is a summary of the key terms used to define the requirements in the units.

Term	Definition
Explore	Learners apply their skills and/or knowledge to practical testing or trialling.
Examine	Learners are expected to select and apply knowledge to less familiar contexts.
Explain	Learners' work shows clear details and gives reasons and/or evidence to support an opinion, view or argument. It could show how conclusions are drawn.
Investigate	Learners' work tests the following through practical exploration: • qualities of materials • techniques • processes or contexts.
Understand	Perceive the intended meaning of (words, a language, or a speaker).

This is a key summary of the types of evidence used for BTEC International Level 3 qualifications.

Type of evidence	Definition and purpose
Case study	A specific example to which all learners must select and apply knowledge. Used to show application to a realistic context where direct experience cannot be gained.
Individual project	A self-directed, large-scale activity requiring planning, research, exploration, outcome and review. Used to show self-management, project management and/or deep learning.
Development log	A record kept by the learner to show the process of development. Used to show method, self-management and skill development.

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